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A year course in ninth-grade science was improved by the evaluation of each lesson using a learning profile student rating technique. The purposes of the study were to maximize efficiency of science instruction, to measure improvements, to test effectiveness of new materials, to suggest ways of improving instruction, to evaluate activities on a minute-by-minute basis, and to refine evaluation techniques.

A control class was taught 18 classroom activities by traditional methods. Each student recorded on a five-point scale the degree to which he believed he was learning. The learning responses of the students were plotted in graphic form. Educational communication experts evaluated the learning profiles and suggested new materials and methods. These were then used in the experimental group. The learning profile method used for evaluation by the experimental group was similar to that used by the control group. Students made ratings, ratings were recorded, pictures were taken of classroom activities, a tape recording was made, and the material was put in graphic form.

Both experimental and control groups were tested after each unit; the test was composed of verbal and visual items. An atlas of learning profiles was prepared which contained the level of learning during each minute of the course, subject matter being taught, and photographs of class activities. Overall learning of the course was increased 4.8 percent. The learning profile technique was a practical means for analyzing instruction and was usable at the ninth-grade level. Charts and a bibliography were included.

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new media for improvement of science instruction

REPORT OF A STUDY SUPPORTED IN PART BY A GRANT FROM THE OFFICE OF EDUCATION, U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE, UNDER TITLE VII OF THE NATIONAL DEFENSE EDUCATION ACT OF 1958.

The University of the State of New York
The State Education Department
Bureau of Classroom Communications

J 0395

April 1964

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The State Education Department/Albany, New York

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FOREWORD

This study is an exhaustive analysis of learning taking place in a course of study. Every minute during the 155 class sessions was evaluated, new educational communications media were added and then the improved lessons were evaluated. This resulted in some improvement in learning but, more important, an analysis of the data disclosed how substantial learning gains might be achieved. This publication demonstrates how the new educational media may be extensively used to improve instruction.

Appreciation is extended to the Albany Public Schools and Mr. Sidney Mason who taught the course. No attempt was mede to alter the basic course as it was taught and it does not represent any special demonstration of curriculum content by the New York State Education Department.

Teachers and curriculum designers may find this publication useful for suggestions concerning available visual materials and may be able to estimate the effectiveness of their use. Educational Communications specialists will find the section on the relative effectiveness of the new media of interest. They will also be interested in the prospects for greatly improved instruction suggested in the conclusions and detailed in other studies.

The first section details the overall experiment and summarizes the findings. The second includes profiles of each lesson and reasons for variations in learning.

NEW MEDIA FOR IMPROVEMENT OF SCIENCE INSTRUCTION*

Loran C. Twyford
John G. Church
Hildreth H. McAshan
Robert M. Brown

Summary Abstract

A year course in ninth grade science was improved by evaluating each lesson using a learning profile student rating technique and introducing new educational media which were found to be effective into a second class. The improved lessons were evaluated by the same technique and comparisons of learning were used to determine the relative effectiveness of 18 classroom activities including educational media. Experimental and control groups were tested after each unit, with tests composed of verbal and visual items. An atlas of learning profiles was prepared which indicated the level of learning during each minute of the course, what was being taught and a photograph of class activities. Overall learning of the course was increased 4.8%. The learning profile technique was found to be a practical means for analyzing instruction.

Learning from individual films and other educational communications materials has been shown to be more effective than learning from regular instruction. However, little or no increase in learning has been found when educational communications media have been introduced into entire courses of instruction. Over 100 research studies have shown television instruction to be as effective as regular instruction but it is not often superior.

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*This research was supported in part by Grant No. 7-30-044.00 from the United States Office of Education, Department of Health, Education and Welfare. The principal investigator was Loran C. Twyford. John Church was responsible for learning profile preparation and course improvement. Test preparation and administration was the responsibility of H. McAshan. Robert M. Brown supervised data analysis.

C. R. Carpenter and L. P. Greenhill at the Pennsylvania State University reported[1] that in two highly visualized courses learning was no greater and in one case was inferior to the regular lecture-blackboard presentation over television. Hope Klapper[2] also found decreased learning in a visualized television course.

Purpose of study

There were several purposes in conducting the present study.

1. To maximize the learning in a course in science through the introduction of the most effective educational communications materials and to measure the amount of improvement.

2. To determine the relative effectiveness of educational communications materials and instructional methods used in a year long science course.

3. To develop suggestions for the improvement of science instruction using educational communications materials.

4. To evaluate and record minute-by-minute all activities in a year-long science course and prepare an atlas of these activities.

5. To refine the learning profile evaluation technique and determine its applicability for extended evaluations.

METHOD

Ninth grade general science was selected as the course to be evaluated and improved because this course had the greatest potential for having the findings implemented. The general procedure consisted of evaluating a normal lesson being taught. Educational communications materials were selected and introduced into the lesson when it was taught to a second class. Learning by the second class was then evaluated to determine the extent of improvement. Specially prepared unit tests were given periodically to measure learning visually and verbally. The amount of learning during each minute of the year long course as reported by the pupils was recorded and plotted in an atlas which indicated what content was covered and what visual activity was occurring at the time. An analysis of each type of classroom activity indicated the relative effectiveness of each in producing learning. The unit tests indicated the extent of improvement of the course.

Subjects

The subjects for this study were two classes of ninth grade students at Philip Livingston Junior High School, Albany, New York. There were 30 students in each class and they were taught by the same teacher. Unit test scores were compared for groups of 10 students matched on the basis of sex, I.Q., and past academic performance. A pilot study was conducted the preceding year for a period of one month to discover the ability of students to perform the rating task required of them. During the formal experimental period two additional classes were taught with experimental materials to increase the number of students involved in the experiment. However, it was found to be impractical to provide the materials and conduct the complex evaluations and recording of data. Therefore, the formal evaluation was based on only two classes of 30 students each.

Learning profile evaluations

Conventional methods of measuring learning during a class session utilizing pre and post tests were not practical for the extensive evaluation required in this research study. Instead, a learning profile evaluation technique[3,4,5] developed by the principal investigator was used. It is a method whereby students using electrical summating equipment continuously rate on a five point scale the degree to which they believe they are learning at each instant in a lesson. Each student had a dial which he turned to indicate how much he believed he was learning. The dials of all students in the class were connected in series and the summated response was read with an ohmmeter. This combined learning response was plotted as the horizontal distance against time on a learning profile (Fig. 1). The method is ideal for locating strong or weak spots during a class session and the results are available immediately for analysis. This method of assessing the learning of a group is much more rapid than the preparation, administration and analysis of tests although it does not replace tests for measuring the amount of learning by individuals.

The learning profile evaluation technique has high face validity and research has shown that the results are highly correlated with results obtained with pre and post testing. Students doing the rating of learning were given a one hour training session and several reviews on the method of rating their learning. The training session consisted of showing a specially prepared ten minute film which presented standardized rating instructions and some interpretation of these instructions. This was followed by a trial film which was rated. The students then discussed reasons for indicating learning at various points in the film. Depth interviews were undertaken with ten

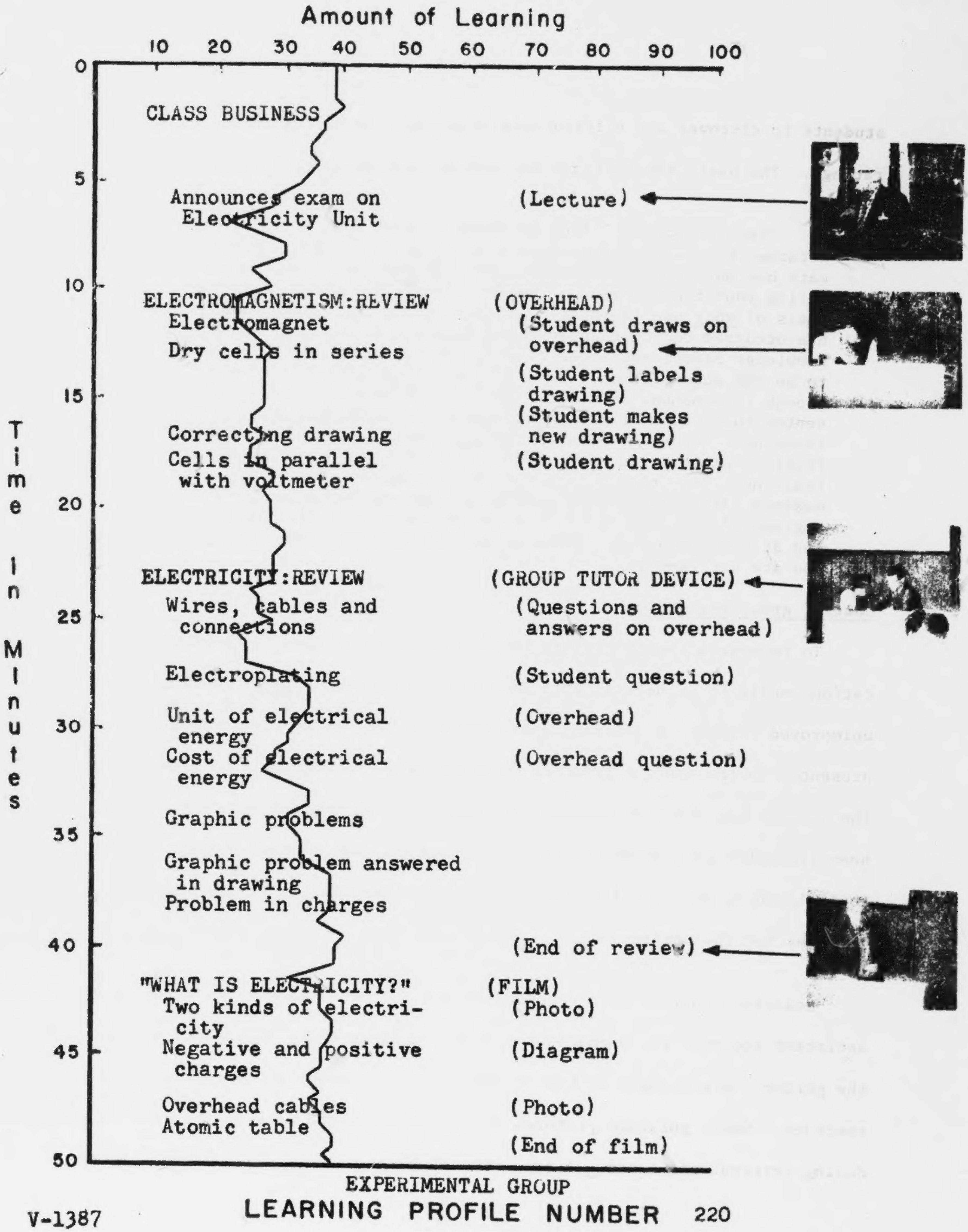
Amount of Learning
10
20
30
40
50
60
70
80
90
100
Time in Minutes
0
5
10
15
20
25
30
35
40
45
50
CLASS BUSINESS
Announces exam on Electricity Unit
(Lecture)
ELECTROMAGNETISM:REVIEW
Electromagnet
Dry cells in series
Correcting drawing
Cells in parallel with voltmeter
(OVERHEAD)
(Student draws on overhead)
(Student labels drawing)
(Student makes new drawing)
(Student drawing)
ELECTRICITY:REVIEW
Wires, cables and connections
Electroplating
Unit of electrical energy
Cost of electrical energy
Graphic problems
Graphic problem answered in drawing
Problem in charges
(GROUP TUTOR DEVICE)
(Questions and answers on overhead)
(Student question)
(Overhead)
(Overhead question)
(End of review)
"WHAT IS ELECTRICITY?"
Two kinds of electricity
Negative and positive charges
Overhead cables
Atomic table
(FILM)
(Photo)
(Diagram)
(Photo)
(End of film)
EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 220
V-1387

Figure 1

students to discover any difficulties they might be having in making accurate ratings. The basic instructions for making ratings were as follows:

> "Each of you will find attached to your desk a dial attached to a wire. The knob on it is to be turned to indicate how much you are learning when information is presented during your class period. You are to rate the program on the basis of your own learning. Learning means that some change has occurred to you that we could discover by testing your knowledge before and after class. You may consider learning to be the acquisition of new facts which you understand well enough to remember at a later date. When information is presented that you already know you should report that you are not learning. Material which is too difficult may not be learned. Point the knob to the None end of the dial when you are not learning. Turn the knob to Most when you are learning at a maximum rate. The positions between represent intermediate degrees of learning. Will you now indicate that you are learning at a maximum rate. Now, at an intermediate rate. Now that you are not learning."

Control group evaluation

To improve a lesson through the introduction of educational communications media it is necessary to know the strong and weak points of the unimproved lesson. A learning profile evaluation was made of each lesson presented to the control group of 30 ninth grade general science students. The teacher was asked to present the lesson in the same manner that it had been presented in previous years. The students made continuous ratings of their learning during all activities that occurred in the 50 minute class sessions for the entire year.

Learning profiles were recorded in the following manner. A graduate assistant recorded the summated rating of learning every 30 seconds during the period. A statement of the corresponding classroom activity was also recorded. Small polaroid pictures were taken from the back of the room during critical sequences. A tape recording was made of each lesson. During the class period the content and method were recorded on a learning profile chart for inclusion in an atlas of profiles. At first the ratings of learning were recorded every ten seconds but experience indicated that this was not necessary for the present purpose. The tapes were played back to aid in the interpretation of profile peaks and valleys.

Interpretation of control group learning profiles is an art that improves with experience. Peaks and valleys indicate that learning has or has nor occurred but do not indicate why. There may be nothing to learn or the presented material may be confusing or too difficult. It was one of the duties of the educational communications specialist to study these profiles and to understand why the peaks and valleys occurred. A knowledge of what was being taught was most important in reaching a decision. If little or nothing was being presented then learning would be low. Interviews with students gave clues as to reasons for limited learning during some periods. The teacher was often able to explain the lack of learning. Tape recordings were used to discover errors, confusion or lack of constructive learning experiences. As the year progressed it became progressively easier for the specialist to predict the reason for learning variations and to predict which activities would result in these variations.

Improving the instruction

Once the control group learning profile was analyzed the educational communications specialist prescribed materials and methods for improving instruction in the experimental class. Since the experimental class met within a period of one day it was necessary to obtain materials in advance. Manufacturers of visual materials and equipment made their products available for evaluation. General science textbooks were procured for obtaining ideas suitable for the preparation of visual materials. Education Department guides gave suggestions for visualizing the lessons. An artist prepared overhead transparencies, charts and other special materials. All available equipment was used, as appropriate, to improve instruction. This included microprojectors, polarized transparencies, magnetic boards, projected laboratory experiments, television and programed instruction as well as the more common recordings, filmstrips, pictures, slides and films. The experimental room was equipped to facilitate the use of instructional aids. This included screens, room darkening, overhead projector, motion picture and slide projectors, a special laboratory table and recording equipment for recording classroom activities.

The educational communications specialist worked closely with the classroom teacher to assist him in the introduction of the new media and materials. It was necessary to establish a reasonable amount of additional work for the teacher to do. If an excessive amount of preparation were required, the findings could not be considered to be transferable to the other schools. The teacher was given some time to make additional preparations but the time was limited. When the improved instruction was presented to the experimental class the specialist had an opportunity to check on his ability to communicate new methods to the teacher by observing the actual method used by the teacher.

Experimental group evaluated

The learning profile method for evaluating the experimental group was essentially the same as that employed with the control group. Thirty students made ratings, ratings were recorded, pictures were taken, a tape recording was made and the material was put in graphic form.

Interpretation of the learning profiles was somewhat different since a direct comparison could often be made between a topic taught by the teacher and the same topic taught with film. The control and experimental learning profiles were collected in a book. The specialist then made an analysis of what occurred and described his success in improving the lesson. As the year progressed he was able from experience to synthesize these analyses into a set of suggestions which seemed to improve instruction.

Objective testing of instructional units

Objective tests of achievement were constructed by the research coordinator to measure the extent of improvement actually realized. Questions were written to cover all possible facts taught in the unit. This was accomplished by analysis of the text, lecture notes and visual materials used in the instruction. The test items were reviewed by several science teachers and the supervisor of science instruction for the city schools. These questions were then reviewed, technically edited and formed into complete multiple choice tests by the State Education Department's Bureau of Testing Services and other Department personnel.

The tests were further refined through the use of a simple index of item discrimination by the upper and lower 27½% of the students. Questions missed by the upper group more frequently than by the lower group were among those eliminated from the final test. A special effort was made to include visual items in the test since other studies had suggested that this might be important. Test questions were answered on IBM answer sheets.

Experimental procedure

The experimental procedure was not as complicated as might be expected for several reasons. Both experimental and control groups were involved in a rather complex rating procedure which would restrict the transferability of findings to other schools. Therefore it was decided to conduct another experiment at a later date with better controls and less chance for adverse "experimental effects". In addition, it was found to be impractical to increase the number of schools getting the experimental treatment during the first year. There was also some concern that we did not yet know the rules for improving instruction. In view of these considerations the primary concern of measuring learning gains was to determine if the methods being employed were giving a reasonable improvement in learning.

As stated before, the experimental and control groups each had 30 students and they were tested after each unit. One class was taught during the third period and the second was taught during the fourth period by the same teacher. After the third, sixth and eighth units the experimental and control groups were rotated. This was done to minimize time of day errors and to equalize the treatment given to each group. The instruction to each group was essentially the same since the same teacher taught each group. It was not possible to correct for any predisposition he might have had to keep both groups equal or to favor either group except as provided for in rotation of groups.

Data to be examined

Test scores were obtained for each unit of instruction from all individuals in the experimental and control groups. A separate analysis was made of visual and verbal test items.

The learning profiles contained an immense amount of data. Practical considerations restricted the analysis to the following procedure. Every profile was divided into time segments that represented discrete types of instruction or type of audio visual material. The average profile amplitude was determined for each of these segments. Also the duration of each segment was recorded. Then an average for all like segments was obtained. Thus, the average profile amplitude for films could be stated as a certain amount.

Several minor corrections were applied to the profiles prior to the analysis. During the first month there appeared to be a downward drift of ratings. A slight correction was made so that the mean rating coincided with later months. A similar minor correction was made for the first five minutes to correct for any error introduced by the wording of the rating instructions. Profile amplitude was always given in percentage to correct for absentees. This was accomplished by adjusting the electrical rating equipment for the number of students present each period.

Another source of data was the comments on the profiles made by the educational communications specialist. These subjective reactions to profile amplitude measurements were crystallized into a set of suggestions for others to use in improving instruction. An analysis of profile peaks was useful in developing these suggestions. The highest peaks that occurred during the year were classified according to the type of media being used. This supplemented the measurement of average amplitude described in the previous paragraph.

RESULTS

Learning by the experimental group Table I was found to be 4.8% greater than that of the control group. Table II based on a matched group of ten students shows the consistent superiority of the experimental group on each unit test. A good part of the superiority of the experimental group can be attributed to learning measured by the visual items. Improvement of instruction did not appear to increase as the year progressed and experience with the media was acquired.

In contrast to the small improvement measured by tests, the learning profile technique demonstrated that some classroom activities were several times more effective than others. Table III gives the average ratings of learning for eighteen classroom activities. The central figures give the ratios of learning by the various methods. Color films were rated five times as effective as test reviews. Opaque projection of material was rated to be more than twice as effective as individual study. This table gives the relative effectiveness of the more common general science classroom activities which were employed by the experimental group.

On the following pages is a list of suggestions developed by the educational communications specialist as a result of using the learning profile technique over a period of one year. A more detailed description is carried in the atlas of science profiles.

One of the more important results of this research is a record of the degree of learning that occurs every minute during an entire general science course. This information is included in the atlas of science profiles which follows. It lists hundreds of visual aids, indicates what is being taught by picture and word and shows what happened to the learning. Profiles are shown

	Visual Items	Verbal Items	All Items
Control Group	9.52	27.20	36.72
Experimental Group	11.15	27.36	38.51
Percent Difference	17.1%	.5%	4.8%
Level of Significance	1%	not significant	5%

Table I Mean scores for entire year of General Science Instruction (Thirty students in each group)

Unit	Visual Items		Verbal Items		Total Items	
	Control	Experimental	Control	Experimental	Control	Experimental
Metric System	5.77	10.50	20.88	20.30	26.65	30.80
Matter and Energy	8.70	10.10	33.40	32.60	42.10	42.70
Air Pressure	8.80	10.44	17.90	19.56	26.70	30.00
Heat	15.20	18.80	33.60	32.60	48.80	51.40
Sound	10.22	10.44	22.00	23.77	32.22	34.21
Simple Machines	9.22	10.88	18.78	20.88	28.00	31.76
Electricity and Megnetism	6.89	11.22	37.22	39.33	44.11	50.55
Light	8.10	8.40	26.20	26.80	34.30	35.20
Health	8.75	10.50	37.60	39.10	46.35	49.60

Table II Mean Scores for Visual and Verbal Items in General Science Units (Ten matched students in each group)

EXPERIMENTAL GROUP	1 Films,color sound 27.52	2 Films, b&w sound 25.72	3 Teacher demon. 24.07	4 Chalk-writing 21.91	5 Opaque projection 21.56	6 Quest. by Indiv. Stu. 19.87	7 Objects 19.04	8 10x10 local made trans. 18.21	9 Quest. to Class 17.80	10 Group Tutor Dev. 17.73	11 Chalk drawing 17.19	12 Lecture 16.74	13 Tests 15.60	14 Teacher writes on trans. 15.57	15 Actiomatic 13.13	16 Filmstrips 11.53	17 Indiv. Study 10.18	18 Test Review 5.41
18 Test Review 5.41	5.09	4.75	4.45	4.05	3.99	3.67	3.52	3.37	3.29	3.28	3.18	3.09	2.88	2.88	2.43	2.13	1.86	1.00
17 Individual Study 10.08	2.73	2.55	2.39	2.17	2.14	1.97	1.89	1.81	1.77	1.76	1.71	1.66	1.55	1.54	1.30	1.14	1.00	
16 Filmstrips 11.53	2.39	2.23	2.09	1.90	1.87	1.72	1.65	1.58	1.54	1.54	1.49	1.45	1.35	1.35	1.14	1.00		
15 Actiomatic 13.13	2.09	1.96	1.83	1.67	1.64	1.51	1.45	1.39	1.36	1.35	1.31	1.27	1.19	1.19	1.00			
14 Teacher writes on transparency 15.57	1.77	1.65	1.55	1.41	1.38	1.28	1.22	1.17	1.14	1.14	1.10	1.08	1.00	1.00				
13 Tests 15.60	1.76	1.64	1.54	1.40	1.38	1.27	1.22	1.17	1.14	1.14	1.10	1.07	1.00					
12 Lecture 16.74	1.64	1.54	1.44	1.31	1.29	1.19	1.14	1.09	1.06	1.06	1.03	1.00						
11 Chalk drawing 17.19	1.60	1.50	1.40	1.27	1.25	1.16	1.11	1.06	1.04	1.03	1.00							
10 Group tutor device 17.73	1.55	1.44	1.36	1.24	1.22	1.12	1.07	1.03	1.00	1.00								
9 Teacher asks questions to class 17.80	1.54	1.44	1.35	1.23	1.21	1.11	1.07	1.02	1.00									
8 10x10 local made transparency 18.21	1.51	1.41	1.32	1.20	1.18	1.09	1.05	1.00										
7 Objects and specimens 19.04	1.45	1.35	1.26	1.15	1.13	1.04	1.00											
6 Ques. by indiv. students 19.87	1.39	1.29	1.21	1.10	1.09	1.00												
5 Opaque projection 21.56	1.28	1.19	1.12	1.02	1.00													
4 Chalk writing 21.91	1.25	1.17	1.09	1.00														
3 Teacher demon. 24.07	1.14	1.07	1.00															
2 Films b&w sound 25.72	1.07	1.00																
1 Films color, sd. 27.52	1.00																	

Note: Central figures indicate how many times the activities at the top are rated to be more effective than the activities at the left. Figures associated with each numbered item are the average corrected profile amplitude for that item.

Table III Ratings of Relative Effectiveness of Eighteen General Science Classroom Activities as Determined with Learning Profile Technique (Experimental Group)

SUGGESTIONS TO IMPROVE SCIENCE INSTRUCTION

A. General Teaching Procedures

1. Go quickly to the point.
2. Present new information, or present any information which must be repeated, in a new way.
3. Bring some new media very early into the class presentation.
4. Use a variety of educational media.
5. Plan to cover more material.

B. Motion Pictures

1. See if a motion picture is available to cover each topic.
2. Ask the students to look for the answers to particular questions as they view a film.
3. Use the film more than once.
4. Skip general, introductory, dramatic, and historical sequences in films.

C. Overhead Projection

1. Plan and design the content of overhead transparencies yourself.
2. Save time by using the overhead for routine tasks.
3. Present difficult points by simple, clear-cut steps.
4. Give frequent quizzes which are to be considered in class grades.
5. Use the overhead projector as a "group tutor device."

D. Filmstrips

1. Select pertinent parts of the filmstrip.
2. Use the filmstrip as a part of a group tutor device.
3. Make the filmstrip a part of class activities.

E. Recordings

1. Use disk recordings when appropriate and available.
2. Tape record some presentations.

F. Other Communications Media

1. Use a variety of media.
2. Make both content and communications media new to each student.

for experimental and control classes. The discussion of each pair of profiles describes the new media being employed and attempts to give reasons for profile peaks and valleys. The educational communications specialist who was responsible for this phase of the research describes the basic procedure employed and the suggestions he developed.

Not the least of the results of the study was a refinement of the learning profile evaluation technique. It was discovered that ninth grade general science students can operate the rating equipment adequately for a year's course. This study confirmed that this technique is a simple, rapid and efficient method for group learning evaluation. The results obtained appear reasonable and are useful in instructional analysis. There is some tendency for ratings to center toward a mid-point but this does not interfere with judgements of the relative amount of learning that occurs. One finding which should be applied to future profile evaluations relates to the final instructions given the rating student. Instead of saying "will you now indicate you are learning at a maximum rate, now at an intermediate rate, now, that you are not learning' the correct instructions should read "will you now indicate you are learning at the maximum rate, now that you are not learning and now that you are learning at an intermediate rate." The rater will then be rating near an average value. This eliminates a drift toward increased learning in the profile as more and more students begin to respond. An automatic recording unit was utilized for a period of time in hopes of simplifying the recording task. As in previous attempts it was not found to do so. The photographic recording of concurrent classroom activities was impressive but its value will depend upon the degree of use made of the profiles. The tape recordings of classroom activities were indispensible in a few instances. The time required to review the recordings was one of their shortcomings.

DISCUSSION

Although this research did show an increase in course achievement the small increase of 4.8% was not impressive. It did not produce a decrease in learning evidenced in other highly visualized courses. The profile technique, however, confirmed the very impressive effectiveness of films that many film research studies have shown. One of the anomalies was the low rating given for filmstrips. In fact, many other media were far below films in effectiveness. There is at least one explanation which can account for the weak showing of filmstrips, some overhead projection activities and chalk drawings. This involves the amount of information presented per minute. When a filmstrip is studied slowly a frame at a time the efficiency of the visual message is dissipated by the inefficiency of the accompanying discussion. Other types of instruction that are not carefully preplanned may rate low. The relative effectiveness chart lists black and white and color films, teacher demonstrations and chalk writing as the most effective classroom activities. All of these are carefully programed, highly efficient presentations. In a sub-study of profile peaks some filmstrips appeared to be as effective as films for short periods of time. This suggests that filmstrips may be used in a very efficient or a very inefficient manner. It also suggests that introducing and discussing a film afterwards may produce more learning but that the added time which is required may reduce the efficiency of the instruction.

We are now discussing educational efficiency rather than effectiveness. The value of learning efficiently from a film for a few minutes is lost if this film is later discussed for an hour by an inefficient class discussion method. There is little need for a highly efficient lesson if it is followed during the next few lessons by questions to class or test question review which are probably inefficient means of instruction. Although more learning occurs by introducing and reviewing a film it is important to determine whether even more learning could not be acquired by covering new material during this time.

Instructional improvement to any extent can only occur when a significant proportion of class time is devoted to high efficiency instruction. Study of Figure 2 shows that even in the enriched lessons used in this experiment the high efficiency instruction occupied about 20% of the time or less. If we assume that this instruction is 50% more effective than regular instruction we would still not expect more than a 10% increase in course learning as shown in Figure 3. This is because the period of application of the high efficiency instruction is too short. This analysis supports the 4.8% increase in learning found in this study.

One of the major conclusions we were able to draw from this research was that we cannot expect a large impressive increase in learning unless instruction is made more efficient. The more effective means of instruction must be employed to a much greater extent. A further study was carried out to support this contention.

The efficiency extends not only to the realm of the classroom. Students can learn in the classroom, from homework and from independent study. It is inefficient for a student to learn at home and have the same material retaught in the classroom. A separate study has investigated this aspect of efficiency.

The transferability of research findings to the new situation is always a problem. The rules developed in this study must be used correctly by others if

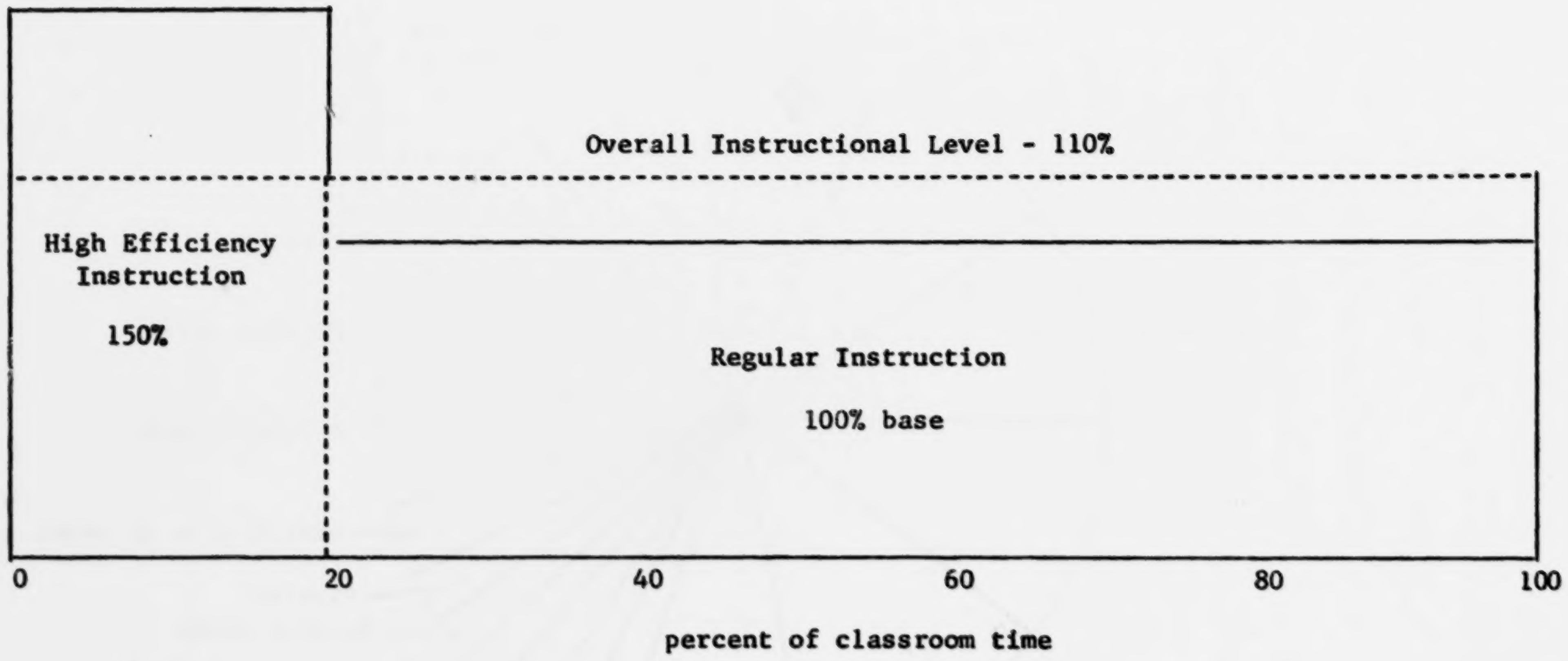

Figure 3 Chart which shows that a small amount of highly efficient instruction used with a large amount of regular instruction increases overall instruction only a small amount.

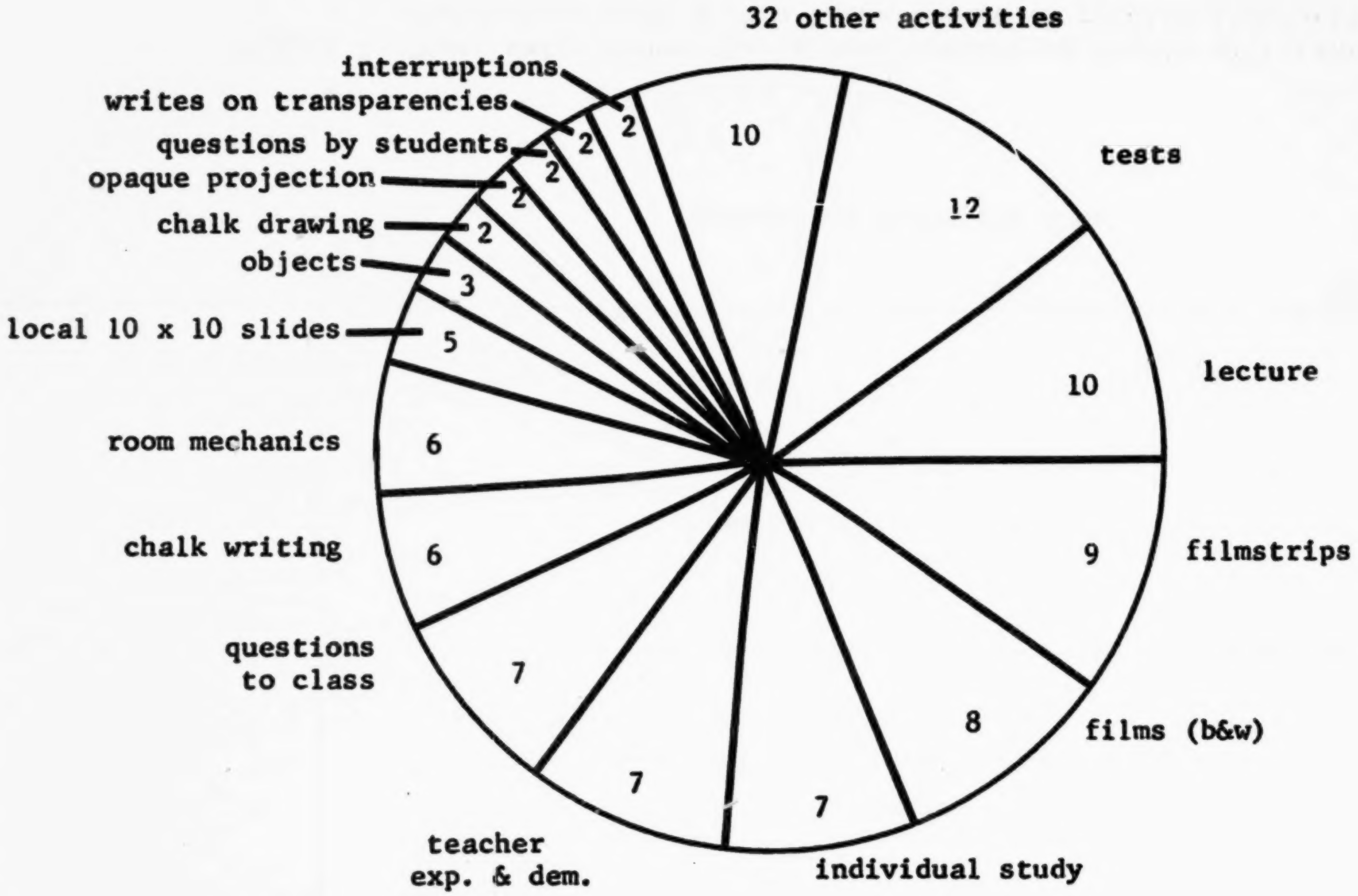

Figure 2 PERCENT OF TIME DEVOTED TO 48 GENERAL SCIENCE CLASSROOM ACTIVITIES - A composite of experimental and control class activities.

similar results are to be obtained. It was also desired to have these rules applicable to televised instruction. Within the limits of experimental feasibility a study was conducted to test the tranferability of research results.

In continuation of this study it was desired to tackle a difficult visualization task; that of algebra instruction. Many of the same techniques used in this study were reused; however, the experimental group was permitted to operate at a more efficient rate rather than to keep in step with the control group. This study is reported separately.

The learning profile analysis technique is a relatively new technique for making comparative analyses of a large number of instructional methods. The technique appears reasonable, has been experimentally validated[3,5] and has high face validity for those who have used it. However it would seem wise to confirm the more striking results with experimental studies designed specifically to measure the instructional methods in question.

This research would appear to have applicability to evaluation of television programs. Most television evaluations have not included visual questions and the results have seldom indicated significant increases in learning. The learning as measured in the present study with verbal questions was not significantly greater than normal. However the learning measured with the visual items was 17% greater and highly significant. Future television evaluations should include a large number of visual test items to demonstrate the positive value of this medium.

In summary, this study has pointed the way to greatly increased learning through the use of educational media. It was not possible to demonstrate adequately the improvement because of the complexities of data collection and scope of the project. Several additional studies which are reported separately follow up promising leads that have been discovered.

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2. Klapper, Hope L., Closed-Circuit Television As A Medium Of Instruction At New York University 1956-57, New York University, 1958, pp. 28-38.

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4. Twyford, Loran C., "Profile Techniques for Program Analysis", Audio Visual Communications Review, Vol. 2, No. 4, Fall 1954, pp. 243-262.

5. Merrill, I.R., Application of Profile Techniques for Training Aid Evaluation, Technical Report; NAVTRADEVCEN 602-11-1 U.S. Naval Training Device Center, Port Washington, L.I., N.Y. Jan. 1959, pp. 1-48.

PART II

ATLAS OF LEARNING PROFILES
CONCERNING
NEW MEDIA FOR IMPROVEMENT OF SCIENCE INSTRUCTION
1960-61

Participating School:
Philip Livingston Junior
High School
Albany, New York

Atlas Profile Project
Directed by:
Dr. John G. Church

I. TECHNIQUE

A most vital part of learning is the process by which it develops. Yet most studies have investigated the results of learning, rather than the process. Typical procedure has been to compare an experimental group with a control group by testing the groups on the amount of information acquired at the end of a certain length of time. This procedure was utilized in connection with the project, but a novel approach to study the process of learning was employed.

Program analyzer technique. The basic procedure was the learning profile technique which has been developed through research conducted by Dr. Loran C. Twyford, Chief, Bureau of Classroom Communications, New York State Education Department.[1] The procedure makes it possible to analyze students' ratings of learning at each moment of a class period.

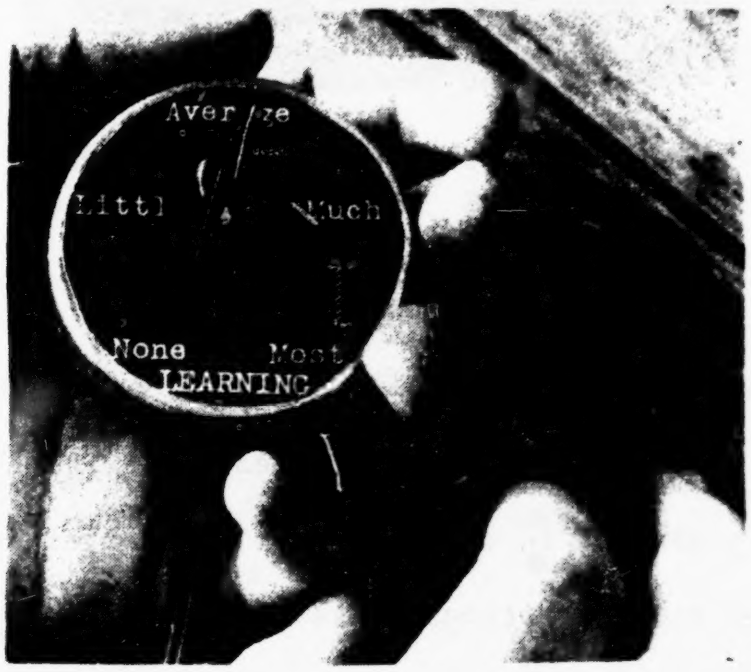

Figure 1. The potentiometer used provided a means of indicating the degree of learning the student was experiencing.

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[1] Loran C. Twyford, "A Comparison of Methods for Measuring Profiles of Learning from Instructional Films." (Ph. D. dissertation, Pennsylvania State University.) Ann Arbor, Michigan: University Microfilms Publication No. 3314, August 1951.

Each student in a class was given a variable resistor actuated by a knob (shown in Figure 1) by which the student was able to indicate the degree of learning which he was experiencing. The ratings of individual students were summated and indicated on a meter.

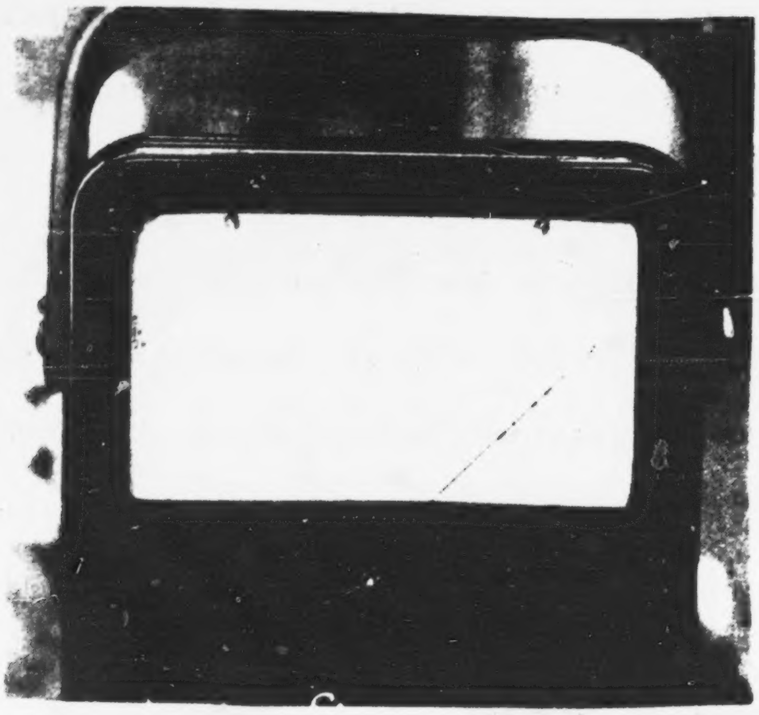

Figure 2 An ohm meter was used to record the average of the ratings of learning by class members.

Learning profiles. The result was the learning profiles shown on the pages to follow. By looking at one of the profiles (for instance Learning Profile Number One) one can see a chart of learning with the vertical axis representing time in minutes in class and the horizontal axis representing the meter reading of student ratings of learning. At intervals of every 30 seconds, the meter reading (Figure 2) was charted by a member of the staff with an indication of the type of class activity in which the group was engaged and the subject matter content.[2] An auditory record was also kept by recording on magnetic tape each of the class sessions throughout the school year.

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[2] This technique and related research have been described in Loran C. Twyford, "Profile Techniques for Program Analysis". Audio-Visual Communications Review, Volume II, (Fall, 1954), pp. 243-262.

Equipment, materials and procedures. A wide variety of communications equipment was utilized (Figure 3). These were indicated, along with instructional materials and techniques, on pages one and two. Many different combinations of equipment, materials, and procedures were introduced.

Duration of study and group rotation. The study was then conducted through the entire 1960-61 school year. Profiles of all types of class activities were kept. In order to make sure that differences between the groups did not bias the results, the groups were reversed after three units so that by the end of the year each of the groups had spent an equal amount of time as control and experimental group. Thus, it was possible to confound the effects of being in a "special class" or an "experimental group" so that there was no interference in the strict appraisal of the use of communications media.

II. PROFILES AND THEIR ANALYSES

Improvement by profile study. As soon as a control class was completed, a careful analysis of the learning profile was made. Newer media of communication were developed or acquired in order to replace low points in the learning profile. Essentially the same information was then presented in the experimental group with the only variations being the introduction of new media to replace those low points which had occurred in the control group.

Interpretation. A written analysis was then made of each pair of learning profiles. After the completion of the year of study of the profiles,

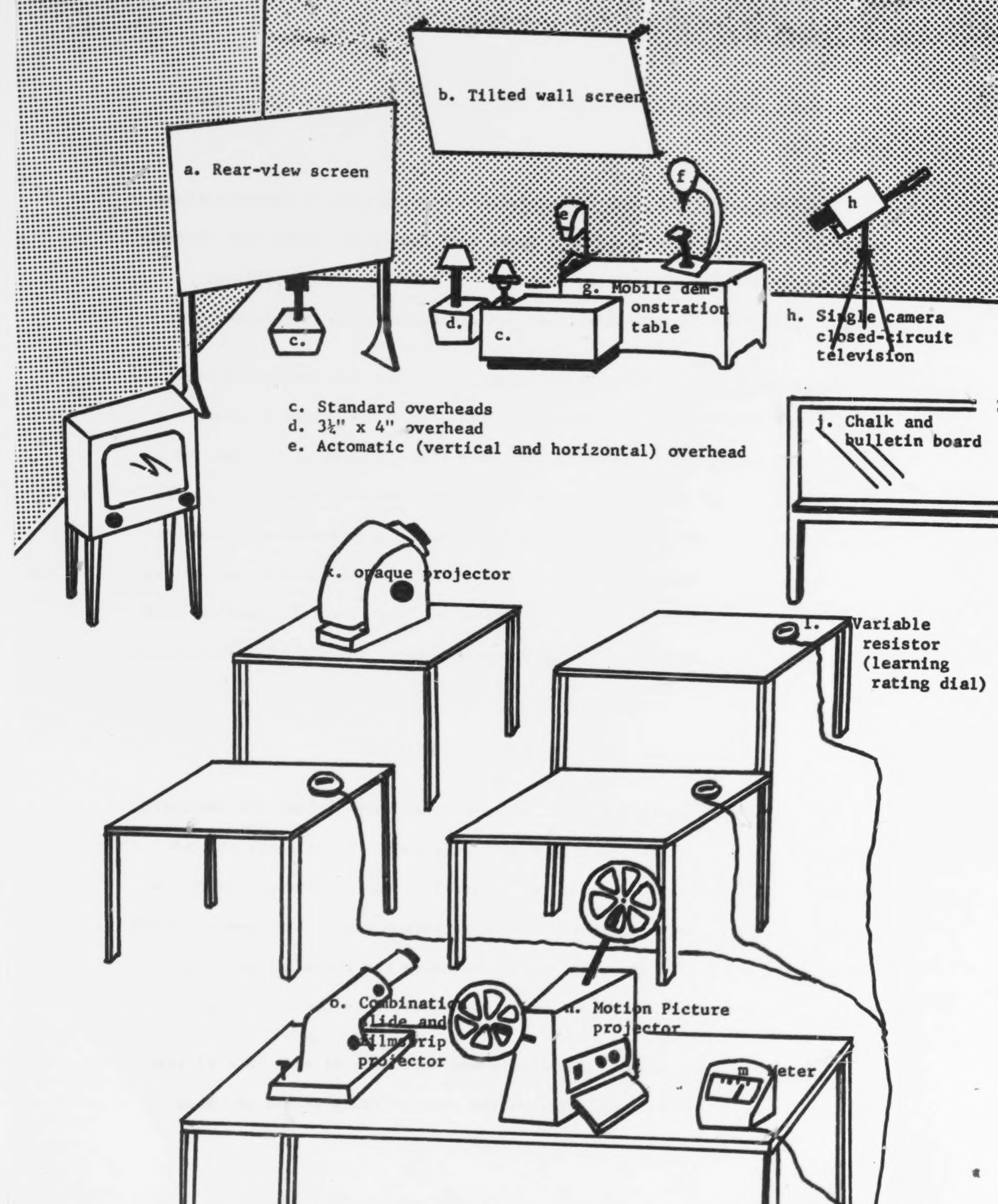
b. Tilted wall screen
a. Rear-view screen
f
e
h
c.
d.
c.
g. Mobile demonstration table
h. Single camera closed-circuit television
c. Standard overheads
d. 3¼" x 4" overhead
e. Actomatic (vertical and horizontal) overhead
j. Chalk and bulletin board
k. opaque projector
l. Variable resistor (learning rating dial)
o. Combination slide and filmstrip projector
n. Motion Picture projector
m Meter

Figure 3. Schematic drawing of equipment placement. (All equipment shown was not in the room at one time.)

important interpretation could be made within the experimental group profiles. However, the range of differences within the experimental group was reduced by the fact that techniques for presenting particular parts of lessons were omitted on the basis of analysis of the control group profiles.

Organization of profiles in the atlas. The following learning profiles are arranged in an order in which the profile for the control group can easily be compared with that of the experimental group.

The first profile shown is the record of learning in the control group and has an odd number. The next profile is facing on the opposite page. It is a record of the experimental group, indicated by an even number. Turn the page to read an analysis of the two profiles.

In comparing two profiles, the relative degree of divergence from each respective profile line on a comparable point of information is particularly significant. Comparable items may not always be on the pair of profiles which face each other since differences in the days on which information was presented to the two classes were sometimes caused by school activities, school business, and student questions.

III. FACTORS AFFECTING INTERPRETATION OF RESULTS

The opportunity to see a class for a whole year through the means of observation, program analyzer, and the other research techniques utilized in the study provided an invaluable means of gaining a total picture of the learning in a school situation. Following are some factors which were observed which give a better overall picture of the study.

Unit tests. Tests were administered to the classes at the end of each unit of instruction. Since no standardized unit tests were available, tests were constructed by the research coordinator in cooperation with the teacher and the State Education Department personnel.

Teacher creativeness stimulated. The availability of communications equipment lead to acts of creativeness on the part of the teacher and led to new effective approaches to teaching.

For example, during Unit III on Air and Air Pressure, after seeing some prepared 10" x 10" transparencies in single and overlay form, the teacher asked the Audio-Visual Specialist how he could prepare transparencies. The teacher then took time on a weekend to make three overlays and four single slides. These resulted in a relatively high level of learning. This teacher also made suggestions for transparencies which could be prepared by the Audio-Visual Specialist.

The teacher decided to make a recorded narration to go with a filmstrip on the flight of airplanes. Explanations were added along with the narration.

Familarity with materials on the part of the teacher in his experimental classes developed such that by the sixth month he used a very effective approach to present a filmstrip.[3] (Control Profile 201)

The filmstrip on electric motors was introduced by the teacher who showed an electric motor, its parts, and their functions. The filmstrip was then shown with a student reading the captions. The teacher made explanations and references to the motor. The teacher selected and used only the best parts of the filmstrip on direct current motors.

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[3] "The Principles of Electric Motors and Generators," Society for Visual Education, 1955. 67 frames, color.

Teacher innovations. Working with the newer media often gave the teacher ideas for uses above and beyond the usual practices. He became particularly interested in the overhead projector and used it to show different types of radio tubes.

At times he also favored the control group by using procedures which he would not normally have used. He used a very nice chart to show the different combinations possible for electric circuits. A few days before a final unit test he told the control group to take notes on a film,[4] because there would be visual questions on the examination. No such reminder was given to the experimental group. In Control Profile 101, the teacher stopped the film for particular points which he made. This procedure was planned for the experimental group and was not a regular part of instruction[5] and led to higher learning than the class would have had without stopping the film for discussion and notes.

IV. PATTERNS OF INSTRUCTIONAL TECHNIQUES DEVELOPED TO THE POINT THAT THEY WOULD BE OF VALUE TO CLASSROOM TEACHERS IN EXPERIMENTING TO IMPROVE INSTRUCTION.

One of the greatest values of research is the opening up of new avenues for practical applications. In the process of studying control classes and devising means of improving instruction in the experimental classes, the following techniques were developed. They are stated in the form of positive suggestions.

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[4] "Light and Power," Instructional Films, 1947, 22 min., sd., b&w.

[5] All control class activities were to be those which were a normal part of instruction.

A. General Teaching Procedures

1. Go quickly to the point. Learning is low during introductions, whether in films or in lectures. A quick, interesting entrance into the topic is highly effective. For instance to show an unusual demonstration which will need to be explained in class is effective whether done live or by film.

2. Present new information, or present any information which must be repeated, in a new way. Do not rehash what the students have already read in the textbook. Oral reading of the textbook by students is very ineffective. Although lectures alone are generally ineffective in comparison to the use of carefully selected new media (a good film for instance), they prove effective where they are illustrated by drawing on the chalkboard or on the overhead projector.

3. Bring some new media very early into the class presentation. The introduction of a topic by a film brings learning to a high level which then continues through the class session.

Classes beginning with lecture or discussion resulted in relatively low learning as shown in Experimental Group Profile 50.

4. Use a variety of educational media. Do not begin to use one type of educational media day after day. Variety itself will do much to bring about increases in learning. Many communications media are now available in the field of general science and one needs only to select from among them.

Among the most effective media are films, overhead transparencies, group programed materials, tape and disk recordings, and demonstrations[6] (See Experimental Group Profile 48.)

5. Plan to cover more material. Plan to cover the same content in greater detail or to cover more material because use of the new media will bring about learning more of the same information in less time.

B. Motion Pictures

1. See if a motion picture is available to cover each topic. Preference should be given to films for presenting information since they are more effective as a general rule than lectures, chalkboard presentations, class discussions, wall charts, use of objects and models, and textbook illustrations. Whether the film is black or white or color does not affect learning.

2. Ask the students to look for the answers to particular questions as they view a film. Use of a lighted flip chart placed by the screen to make possible seeing the questions as the film is viewed proves to be effective. More convenient is projection of questions from an overhead projector to a screen placed beside the screen on which the film is being seen.

3. Use the film more than once. Two or three showings are effective if the film is used in a different way or for a different purpose. One film

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[6] The teacher may refer to his audio-visual director for information concerning the operation of these media, or to James Finn, A-V Equipment Manual, Dryden Press, Inc., New York, 1957.

was used three times on different days, once for introducing a unit, once for careful study using frequent pauses during the film for notetaking and discussion, and once for viewing. In Experimental Group Profile 164 a film was used twice during the same period. The first time it was used with sight and sound and occasional stops for notes and answering questions seen by means of the overhead projector. The second time the sound was left off and the teacher provided a commentary.

4. Skip general, introductory, dramatic, and historical sequences in film. The rate of learning in science classes decreases rapidly when such sequences are included. In previewing the film decide which parts are valuable and should be omitted.

C. Overhead Projection.[7]

1. Plan the design and content of the overhead transparencies yourself. Although commercially made transparencies (ranging in size from 3¼"x 4" to 10" x 10") are available and often useful, transparencies you plan yourself may be more appropriate and more effective. However, the teacher may need technical training or assistance in making them. Guard particularly against putting too much information on one slide at a time; and the printing and details must be large enough to be seen clearly from the back of the room.

2. Present difficult points by simple, clear-cut steps. "Overlays" offer a means by which one step after another can be presented to the group. One acetate sheet can show one phase; then another phase can be added by another sheet which is superposed. (Figure 4)

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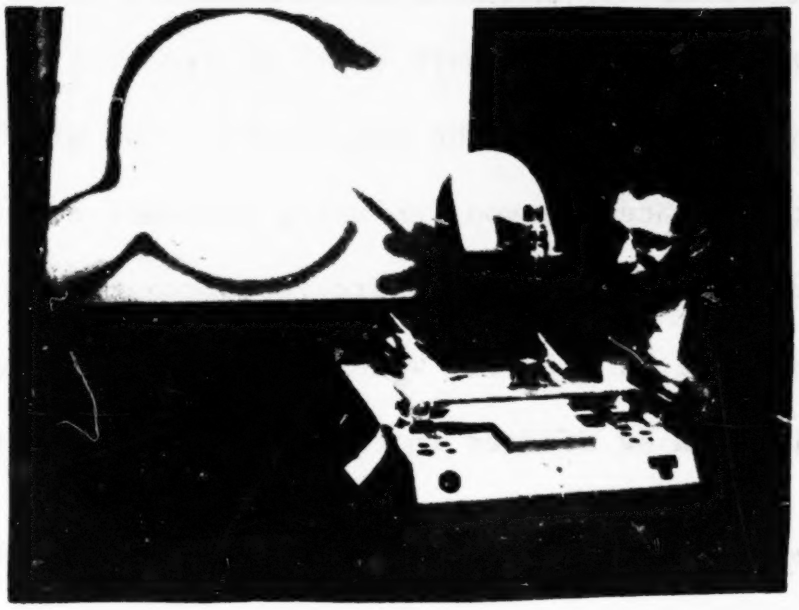
[7] For more information see article by John G. Church, "Overhead Projector", Bulletin to the Schools, XLVII (May 1961), pp. 255-257, (Issued by the University of the State of New York, Education Department).



Teacher facing class while using the overhead projector.

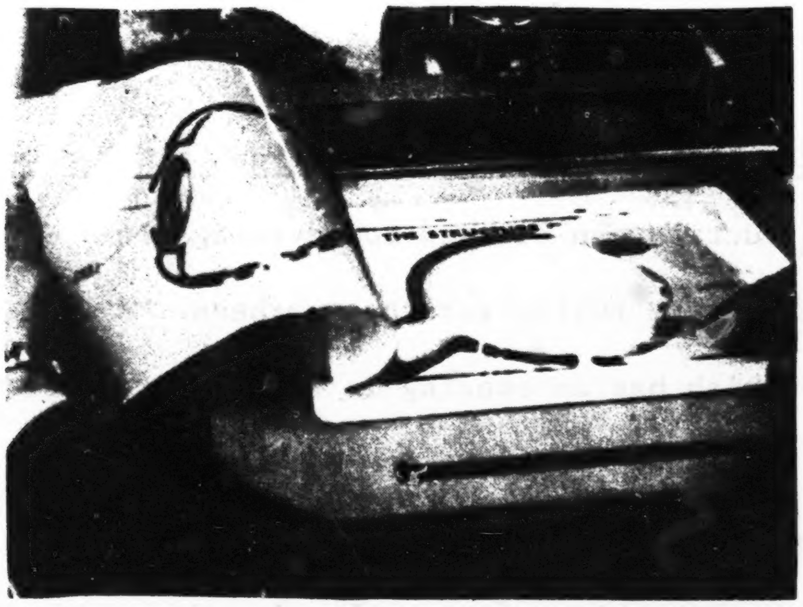


Figure 4. Graphic representation of an abstraction by means of an overlay on the overhead projector can result in more concrete learning.

3. Save time by using the overhead for routine tasks. Time and effort can be saved by placing "board work" assignments on acetate. This reduces the amount of writing on the chalkboard. You will find that by using grease pencil on acetate you can write and make drawings as you would on the chalkboard. Use of the chalkboard is approximately as effective for learning, but less time is required when the overhead projector is used and hence more material can be studied in the same amount of time.

4. Give frequent quizzes which are to be considered in class grades. Students accept the challenge of frequent quizzes which serve as a type of programed instruction when the answers are shown to students immediately after taking the quiz. The quiz written on acetate with india ink can be administered quickly and placed in a file with lesson plans. A grease pencil can be used to mark and project the answers to the test items. A cloth can easily wipe off the grease pencil marks.

5. Use the overhead projector as a "group tutor device." The idea of programed instruction can be used to advantage in your class by preparing a program on the acetate roller for the overhead. A mask can be prepared for the overhead which has an opening in the center about 2" high and 10" wide (Figure 5). This allows light to pass through the slot to, first, a question or statement to which the student writes a response on paper on his desk; then, second, the acetate roller is advanced so that both the question and now the answer are showing so that the student can check his response. Using this group device, the teacher is able to assist the group with explanations or suggestions for related study. Both question and answer need to be written within a space of 2" x 10" (if the mask described

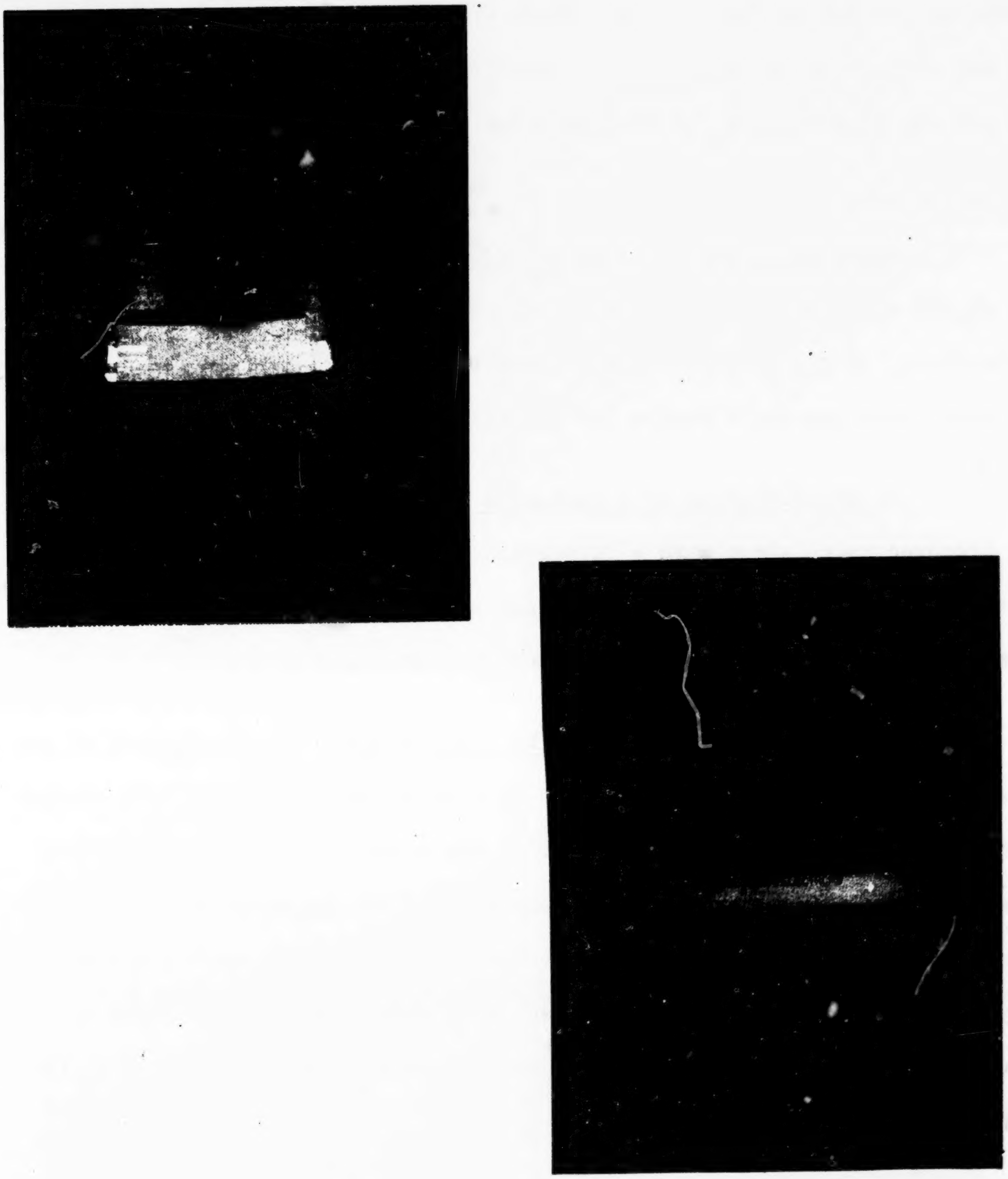


Figure 5. A mask on the projector allows a question to be shown (above); after the students answer, a roller is turned and the answers as well as the question is shown.

above is in use) on the acetate roller. You may wish to obtain permission to use one of the prepared teaching machine programs available commercially; or you may prepare your own program after study of programing techniques.

D. Filmstrips

1. Select pertinent parts of the filmstrip. Preview the filmstrip to decide which parts will be useful in carrying out your teaching objectives for the particular day. Sometimes the filmstrip covers much more material than you would desire for the time available.

2. Use the filmstrip as a part of a group tutor device. Questions can be prepared to go along with a filmstrip on the overhead projector. Then either the filmstrip or the overhead can supply the answer. This combines some of the advantages of teaching machines and visual media.

3. Make the filmstrip part of the class activities. To be part of the class activities the filmstrip should be used in such a way that the teacher can add comments relating the content to the other activities of the class. Questions in or about the filmstrip answered by the students will increase learning. A particularly well-planned lecture to go along with a filmstrip may be recorded on tape for future use or to reduce the time required by the presentation, although it should be planned to stop the playback of the tape for student answers.

E. Recordings

1. Use disk recordings when appropriate and available. Utilization of recordings along with the overhead projector and slides of various dimensions opens the way for use of a variety of media.

2. Tape record some presentations. To save class time you may tape record demonstrations before class on such topics as that of sound. Recording verbal explanations will save time because they can be made concise and can be reproduced in a shorter period of time.

F. Other Communications Media

1. Use a variety of media. Avoid frequent use day after day of any one type of communications material with the same pattern of presentation. The media described in the previous categories will prove effective for many communications media needs, but their effectiveness will be enhanced by using a variety of media.

2. Make both content and communications media new to each student. Whenever either subject matter content is new or the means of presenting it is made novel through communications media, student learning will extend and/or deepen.

One way to insure newness in teaching is to regularly test out new hypotheses. The suggestions in this section will have provided an opportunity to proceed in the direction of action research in the classroom. Possibly educators will want to continue to delve deeper into the effect of the new media in classes. The very process of experimentation in classes will do much to increase learning.

Some of the new tools available to science teachers make it possible to present new material in an effective way and by so doing helps to keep the course content more up-to-date.

VI. SUMMARY

Overall approach. The study provides a Gestalt approach by studying the various parts of the classroom learning situation in relation to the whole course learning environment. All classroom activities were analyzed so that when one was observed it would be seen in relation to the others minute by minute, class session after class session, unit after unit through the entire school year.

Thus, for instance, a particular educational communications medium (e.g. a film) could be observed in many different types of classroom situations: with and without introductions, after tests, accompanied by questions relating to content, as reviews, repeated one or more times, without sound, with occasional stops, and in conjunction with such a medium as an overhead projector. Any influence of teacher comments, censure of students, or ignoring of film could be observed.

Value of trial process. The technique used in the study was basic and practical much like that of a teacher who teaches, evaluates her work, isolates weaknesses, plans ways to overcome those weaknesses, tries out the planned changes, and makes further revisions. A Control Group was studied; a profile of learning in the group was made; low points in the profile were studied; new communications media were planned to raise the low points so that a similar presentation with the media would be more effective. If there were not improvement, then plans for another medium were made, tested, and the process continued as long as the time limits of the study permitted.

This technique is basically practical for improving learning. It is in line with the approach recommended by Kettering[8] for developing inventions. He indicates that we can't just calculate what is best for solving a special problem (in our case, the best learning media to put over a particular idea). No one is intelligent and capable enough to make such calculations. "It has to be a very primitive sort of study which goes back to the very elementary process of trying a thing, learning its weaknesses, and then trying something else."

Such an approach also enables us to know where weak points are thus clarifying the idea of the basic problem.

Often where a short research project is introduced, there is distortion due to the fact of the introduction of the research procedures themselves. This distortion was reduced by the fact that the study continued through the entire school year. The patterns which were consequently revealed can be seen in this atlas of learning profiles.

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[8] Charles P. Kettering, "How Can We Develop Inventors", pp. 223-234.

BIBLIOGRAPHY OF LEARNING MEDIA FOR GENERAL SCIENCE
UTILIZED IN TITLE VII STUDY

Not all media made available for the research project are included here. Only those media which were utilized and on which research data were collected are included. No indication is made in this bibliography as to whether the media were effective or ineffective. The bibliography will make a convenient reference for the classroom teacher seeking communications media which he can evaluate himself as to the effectiveness for his particular classes.

Only generally available materials are listed. In the research study, many materials were produced locally but since these are not generally available they are not listed.

Filmstrips

Air Pressure. McGraw Hill. 1955. 11 min. black and white.

Antibiotics, Disease Fighting Champions. Popular Science. 1957. 32 frames. color.

Atmospheric Pressure. Encyclopaedia Britannica Films. 1955. frames. black and white.

Atoms and Molecules. Row-Peterson. 1958. 46 frames. color.

(The) Cause and Nature of Sound. Jam Handy Organization. 1959. 40 frames. color.

Distributing Electric Power. McGraw Hill. 1951. 53 frames. black and white.

Electricity. Row Peterson. 1948. 48 frames. black and white.

Electricity at Work. Long Filmslide Service. 1951. 47 frames. black and white.

Heating Your Home. Long Filmslide Service. 1951. 43 frames. color.

How Airplanes Fly. McGraw Hill (Popular Science). 1954. 39 frames. color.

How Heat Causes Expansion. Jam Handy. 1959. 37 frames. color.

How Sound Travels. Jam Handy. Heat, Light Sound Filmstrip 7.

How to Read a Resistor. Basic Skill Films. 1958. 21 frames. color.

Light and How It Travels. Jam Handy. 1959. 45 frames. color.

Looking Ahead to Physics. Scribner's Sons. 1958. 46 frames. color.

(The) Mechanisms of Breathing. Encyclopaedia Britannica Filmstrip. 1950. 39 frames. color.

Moving Things from Place to Place--Part A. Modern Engines. Scribner's Sons. 1954. 26 frames. color.

(The) Operation and Use of Transformers. Vernon Long Filmslides. n.d. 32 frames. black and white.

(The) Principles of Electric Motors and Generators. Society for Visual Education. 1955. 67 frames. color.

Producing Electricity. Charles Scribner's Sons. 1957. 32 frames. color.

Pulleys Make Work Easier. McGraw Hill (Popular Science). 1950. 52 frames. black and white.

Putting Sound to Work. Charles Scribner's Sons. Speaking and Hearing Part B.

Resistance. Long Filmslide Servicen. n.d. 47 frames. black and white.

Salk Vaccine. Popular Science (Filmstrip of the Month Club). 1955. 39 frames. black and white.

Science of Musical Instruments. McGraw Hill. (299552)

Simple Machines. Row Peterson. 1947. 67 frames. black and white.

Simple Machines. Row Peterson. 1947. 75 frames. black and white.

Simple Machines. Row Peterson. 1950. 56 frames. black and white.

Simple Machines Make Work Easier. Popular Science. n.d. frames. color.

What Air Pressure Is. Visual Sciences. n.d. 30 frames. color.

What is Magnetism? McGraw Hill. 1953. 61 frames. color.

What is Horsepower? McGraw Hill. (Popular Science). 1950. 52 frames. black and white.

Magazines

"A Clue to the Mystery of Magnetism". Life Magazine. Vol. 49. No. 22 (November 28, 1960) p. 70. multicolor drawing.

Models and Objects

Basic Electricity Kit 606. Product Design, Inc., Redwood City, California.

Model of Ear. General Biological. Turtox Latex Models Supply House. multicolor.

Motion Pictures

A is for Atom. General Electric. 1953. 15 min. black and white.

Action-Reaction. McGraw Hill. n.d. 11 min. black and white.

Air is Action. Coronet. 1947. 10 min. color.

Air Pressure. McGraw Hill. 1957. 11 min. black and white.

Airplanes, Principles of Flight. Coronet. 1960. 11 min. black and white.

Artificial Respiration. Imperial Chemical Industry. 1956. 11 min. black and white.

Archimedes Principle. Encyclopaedia Britannica Films. 1953. 7 min. black and white.

Atmospheric Pressure. Encyclopedia Britannica Films. 1954. 11 min. black and white.

Atmospheric Pressure. McGraw Hill. 1955. 11 min. black and white.

(The) Atom Goes to Sea. General Electric Company. 11½ min. black and white.

Boats: Buoyancy, Stability and Propulsion. Coronet, 1959. 11 min. black and white.

Chemistry of Air. McGraw Hill. 1955. 11 min. black and white.

(The) City. CBS Camera III Series. 1953. 20 min. black and white.

Combustion. Sutherland. 1958. 15 min. color.

(The) Ears and Hearing. Encyclopaedia Britannica Films. 1949. 10 min. black and white.

Electric Circuits. McGraw Hill. 1955. 9 min. black and white.

Electric Circuits. McGraw Hill. 1955. 11 min. black and white.

Electromagnets. Young America Films, Inc. 1949. 11 min. black and white.

Electrostatics. Encyclopaedia Britannica Films. 1950. 10 min. black and white.

Energy. McGraw Hill. n.d. 13 min. black and white.

Fuels--Their Nature and Use. Encyclopaedia Britannica Films. 1958. 11 min. black and white.

Gravity and Center of Gravity. McGraw Hill. 1957. 13 min. black and white.

Heat: Its Nature and Transfer. Encyclopaedia Britannica Films. 1958. 11 min. black and white.

Heat Conduction. McGraw Hill. 1955. 9 min. black and white.

Hemo the Magnificant. Bell Telephone Co. n.d. 11 min. color.

How to Catch a Cold. Walt Disney (Kleenex Co.) 1951. 7 min. color.

Human Body: Circulatory System. Coronet. 1958. 13.5 min. color.

Influential Americans. Columbia Broadcasting Co. 1960. 16 mm. 51 min. black and white.

Laws of Motion. Encyclopaedia Britannica Films. 1952. 13 min. color.

Light and Power. Instructional Films, produced by 20th Century Fox. 1947. 22 min. black and white.

Magnetism. McGraw Hill. 1955. 11 min. black and white.

Matter and Energy. Coronet. n.d. 11 min. black and white.

Mechanisms of Breathing. Encyclopaedia Britannica Films. 1954. 11 min. black and white.

Metric System. Coronet Films. 1956. 13 min. black and white.

(The) Nature of Energy. Coronet. 10 min. black and white.

(The) Nature of Heat. Coronet. 1958. 11 min. black and white.

(The) Nature of Sound. Coronet. 1947. 10 min. black and white.

Ohm's Law. Coronet Instructional Films. 1955. 15 min. black and white.

Properties of Gases. McGraw Hill. 1955. 11 min. black and white.

Rockets, Principles and Safety. Film Associates of California. 1959. 11 min. color.

Simple Circuits. Encyclopaedia Britannica Films. 1943. 10 min. black and white.

Simple Machines: Inclined Planes. Coronet. 1954. 6 min. black and white.

Simple Machines: Levers. Coronet. 1954. 7 min. black and white.

Simple Machines: Pulleys. Coronet. 1954. 6½ min. black and white.

Sound Waves and Their Sources. Encyclopaedia Britannica Films. 1950. 11 min. black and white.

States of Matter. McGraw Hill. 1957. 11 min. black and white.

Strange Case of the Cosmic Ray. Bell Telephone Co. 1957. 16mm. 59 min. color.

Surface Tension. McGraw Hill. 1955. 10 min. black and white.

Television: How it Works. Coronet. 1952. 10 min. black and white.

Theory of Flight. Encyclopaedia Britannica Films. 1941. 11 min. black and white.

Watch Mr. Wizard. United World Broadcasting Co. n.d. 29 min. color.

What is Electricity. Encyclopaedia Britannica Film. 1953. 20 min. black and white.

What is Electricity. Encyclopaedia Britannica Films. 1943. 11 min. black and white.

What is Electricity. Encyclopaedia Britannica Films. 1953. 15 min. black and white.

Slides

Atomic Fission. Transparency 104-5, Visual Research Institute, 1960. 3 colors, overlay.

Electrolytes. Instructolab Slide, C-9200. Laboratory Furniture Co., Inc. 1960. 4" x 5½". black and white.

Electromagnetic Radiation. Transparency IV. C 1-10. Tecnifax Corp. n.d. 7 8/5" x 10". color.

Electron Shells. Transparency 104-1, Visual Research Institute. 1960. 10" x 10" slide. 2 colors.

Galvonometer. Transparency PE4922, Instructolab of Laboratory Furniture Co. 1960. 5½" x 4" slide. black and white.

Migration of Ions. Instructolab Slide C-3200. Laboratory Furniture Co., Inc. 1960. 4" x 5½". black and white.

Sound. Keystone View Co. 1932. 23 slides. 3¼" x 4". black and white.

Sound-Singing Strings. Keystone View Co. 3¼" x 4" slide. Unit C. (L544010), (145). Black and white.

Recordings (Disc)

Science of Sound. Bell Telephone Inc. 1959. Disc Recording 33 1/3 rpm.

(The) Science of Sound. Bell Telephone Laboratories. record. Bands 6 and 7. part of 8.

Textbooks

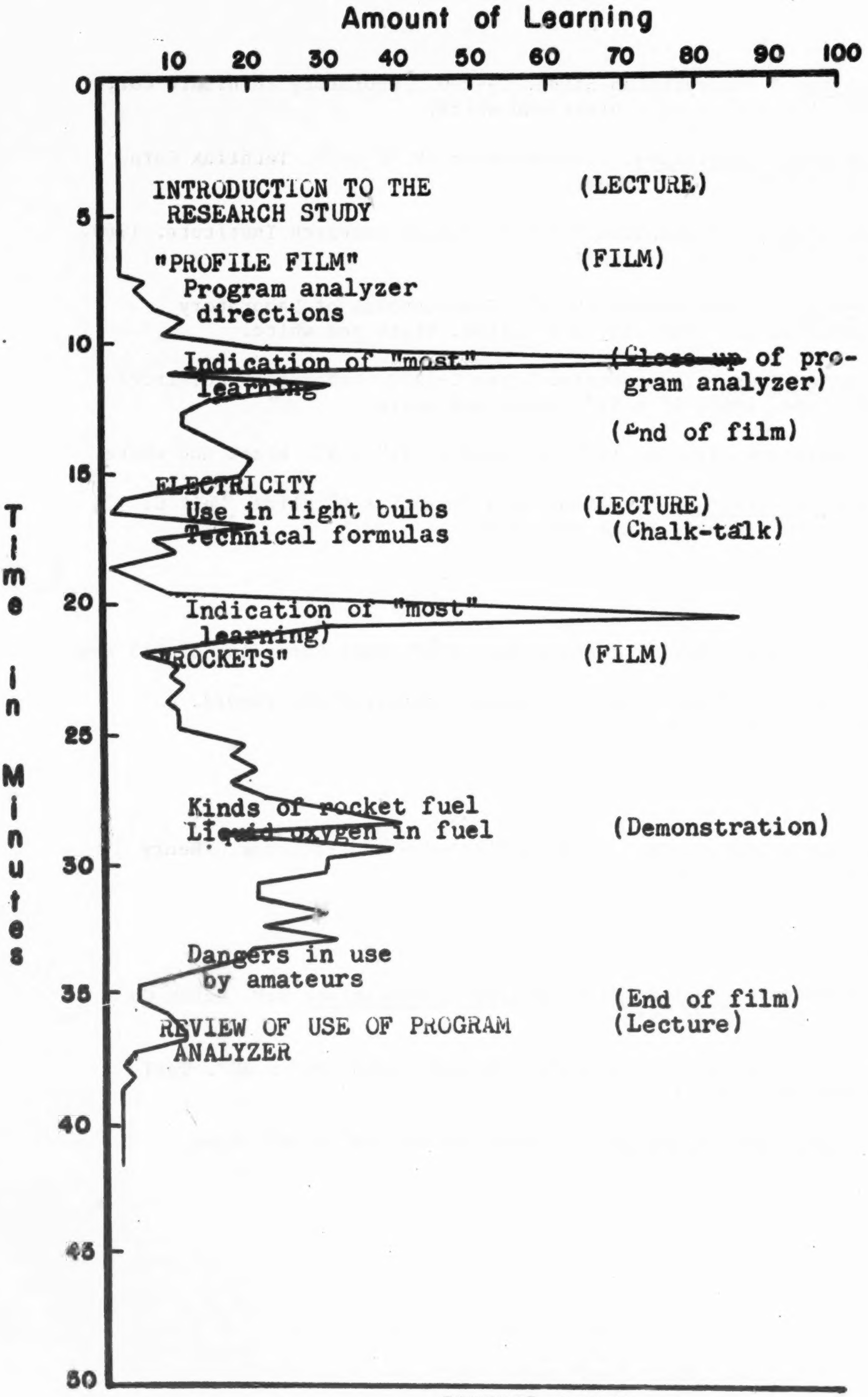
John W. Davis and others. Science Discovery and Progress. Henry Holt Co. N.Y. 1957. p. 410.

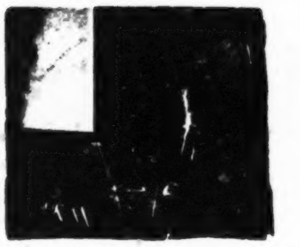
Wall Charts

Arthur Compton. Chart of Electromagnetic Radiation. W.M. Welch Co. 1944. 58" x 41". color.

Ear. (sectioned vertically) Rudolf Schick. 1940. 46" x 30". wall chart. multicolor.

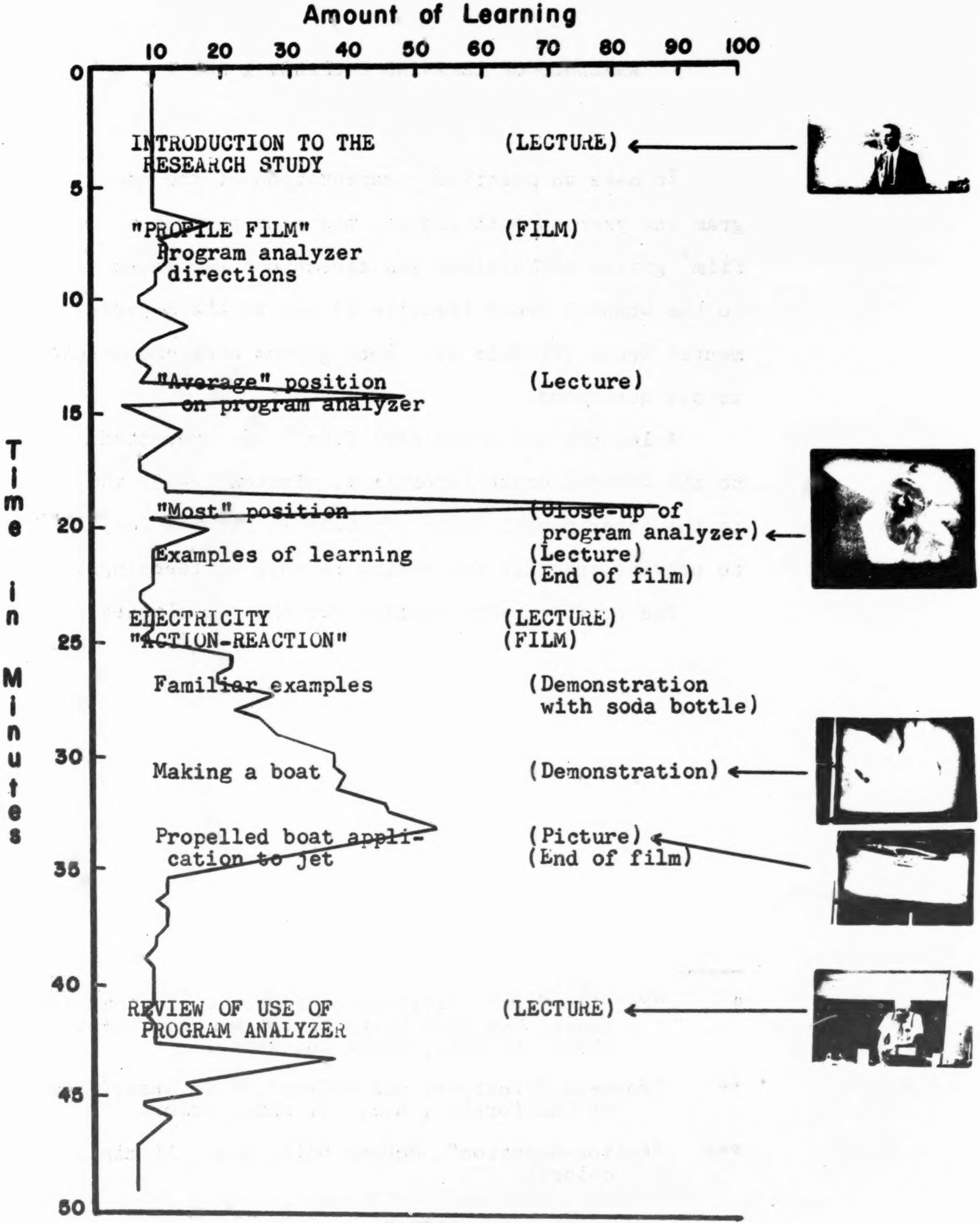
International Metric System. A. Hoen and Co. 42" x 27" chart.





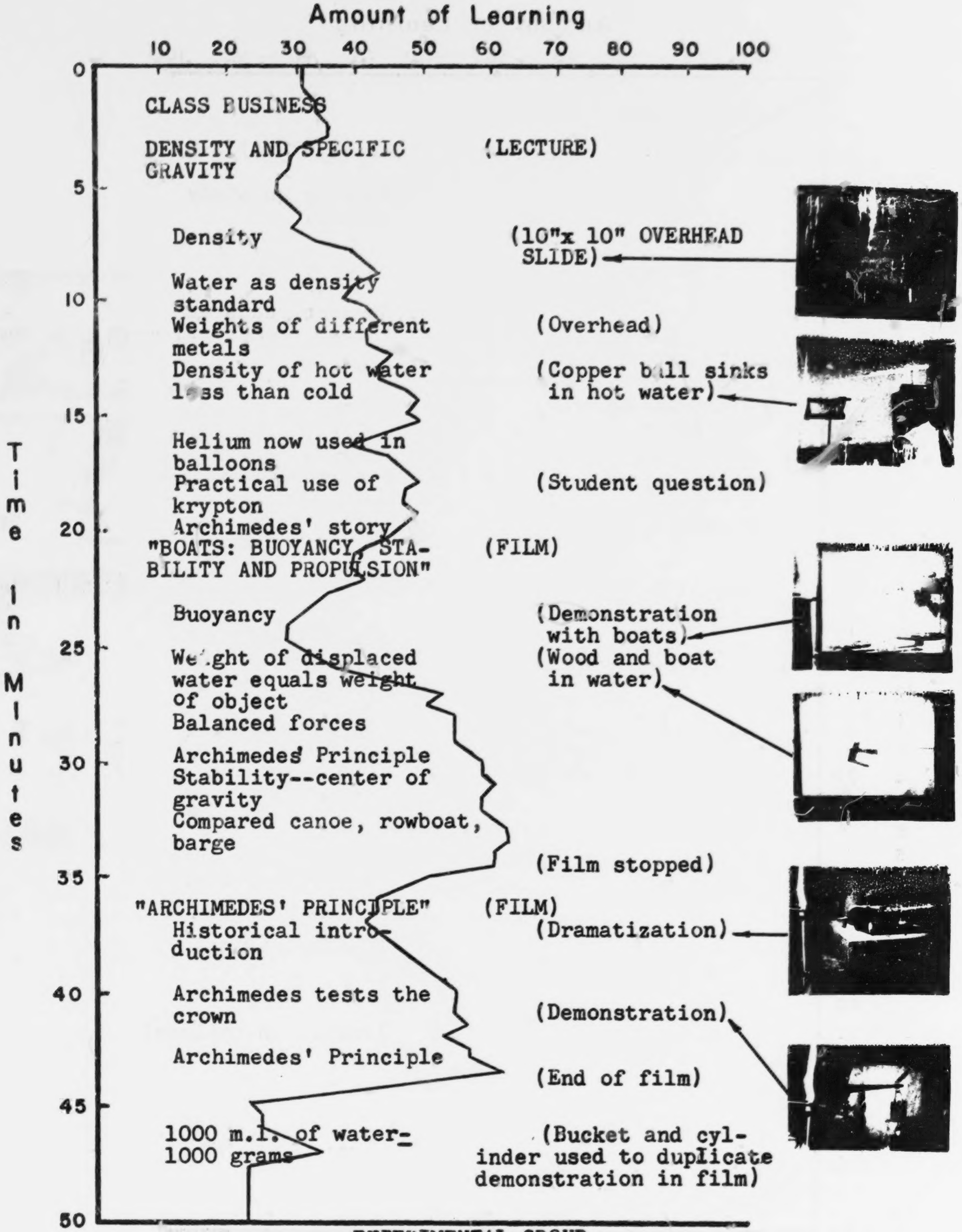
CONTROL GROUP

LEARNING PROFILE NUMBER 1



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 2



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 48

ANALYSIS OF LEARNING PROFILES 47 and 48

An overhead overlay transparency* which had been drawn by the teacher led to greater learning in the Experimental Group (E48, 5-8) than lecturing in the Control Group (C47, 28-32) on buoyancy of gases.

Balanced forces in buoyancy presented by lecture yielded a learning level of 25 percent in the Control Group (C47, 25). But a level of 54 percent was reached in the Experimental Group (E48, 28) by means of a film.**

Buoyancy presented by lecture with objects (C47, 15-42) did not result in as much learning as the film mentioned above and another film.***

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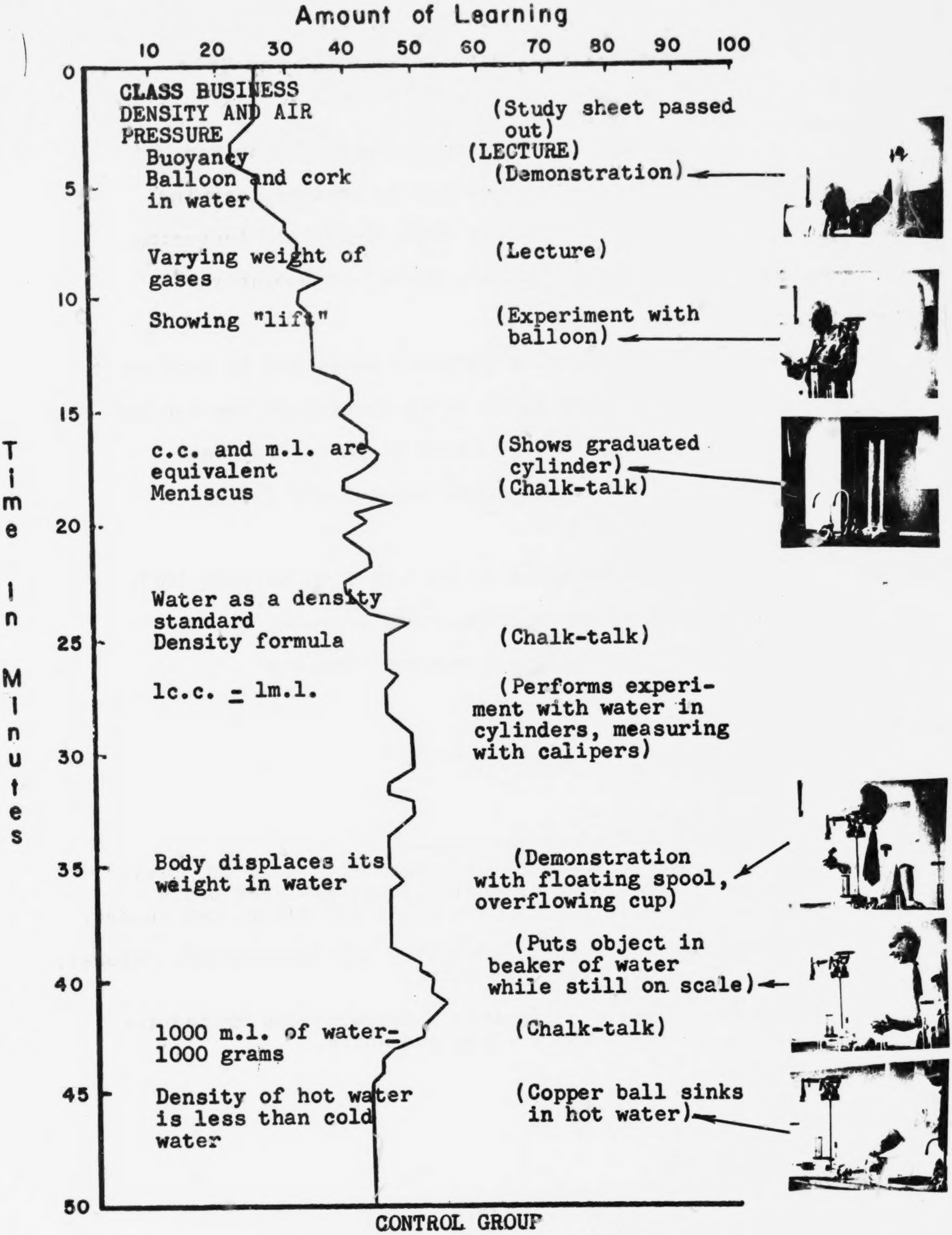
*"Buoyancy of Gases", Transparency III. S., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.

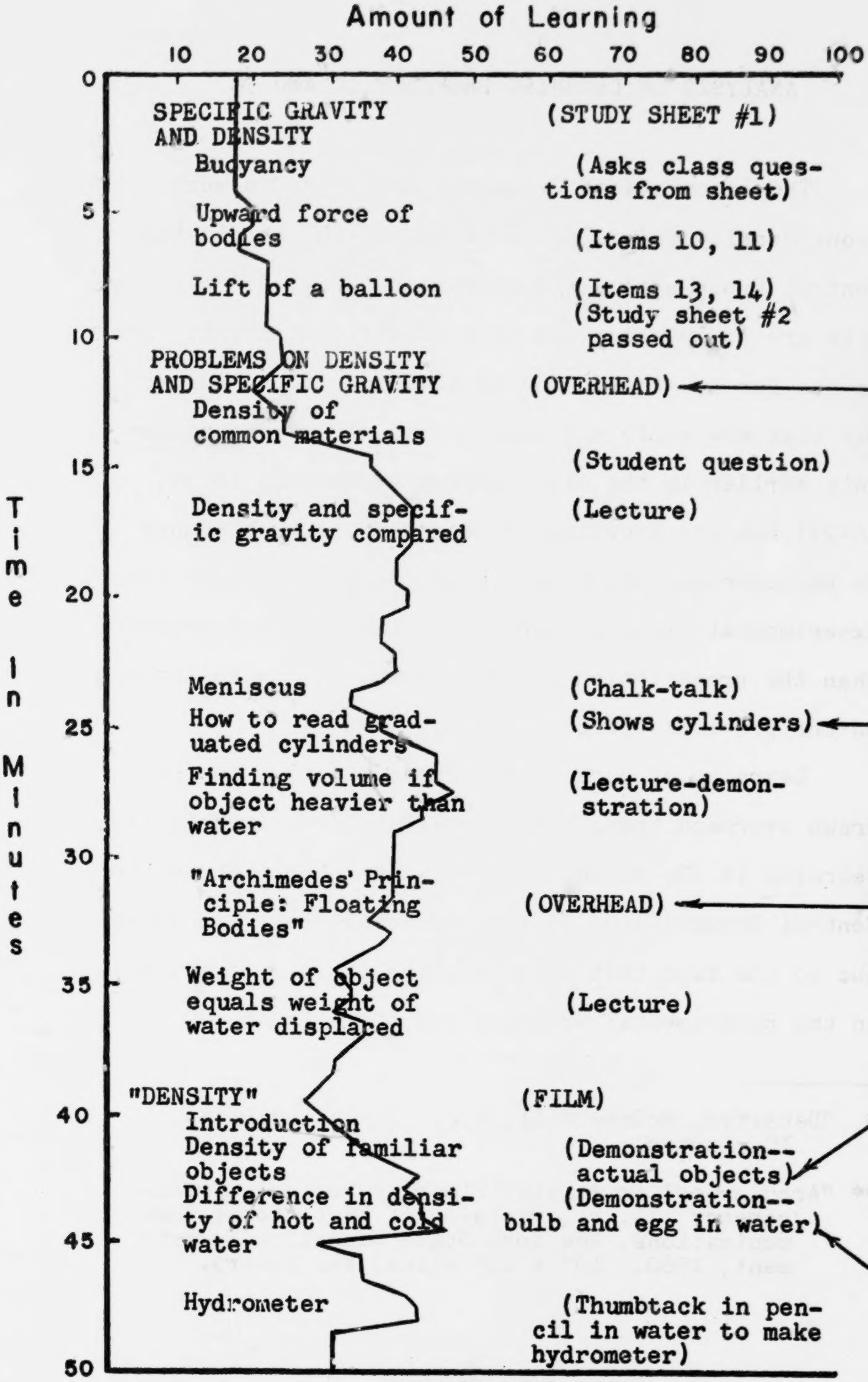
**"Boats: Buoyancy, Stability and Propulsion", Coronet, 1959. 11 min., black and white.

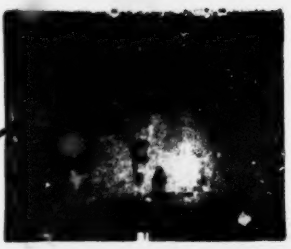
***"Archimedes' Principle", Encyclopedia Britannica Films, 1953. 7 min., black and white.

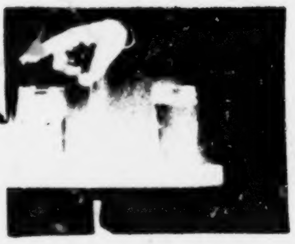


CONTROL GROUP

LEARNING PROFILE NUMBER 49







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 50

ANALYSIS OF LEARNING PROFILES 49 AND 50

The Experimental Group did not learn as much about density from a film* (E 50, 40-50) as did the Control Group with a demonstration (C 49, 23-34). In both groups learning was at a significant level. One reason for lower learning in the Experimental Group was that the topic had been previously presented not only earlier in the class period by lecture (E 50, 16-22) but the previous class day by a transparency on the overhead projector (E 48, 8-15). In both the Experimental Classes just cited, learning was greater than the presentation on density in the Control Group on the previous class day (C 47, 21-24).

Learning of Archimedes' Principle by a teacher-drawn overhead transparency overlay** resulted in less learning (E 50, 30-38) than by a demonstration in the Control Group (C 49, 35-41). However, this was again due to the fact that this had been taken up previously in the Experimental Group by two films (E 48, 30 and

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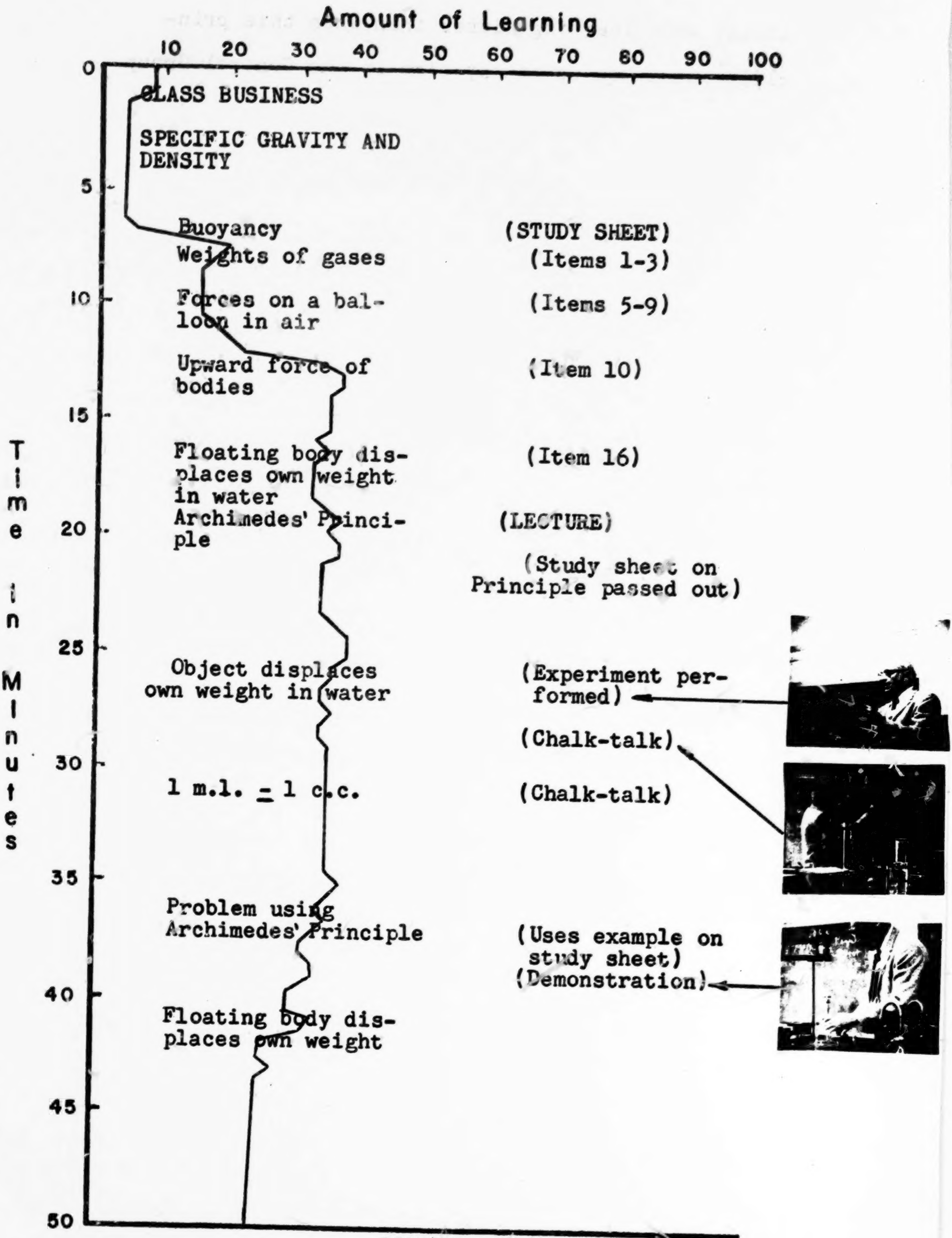
* "Density", McGraw Hill, n.d. Black and white, 10 minutes.

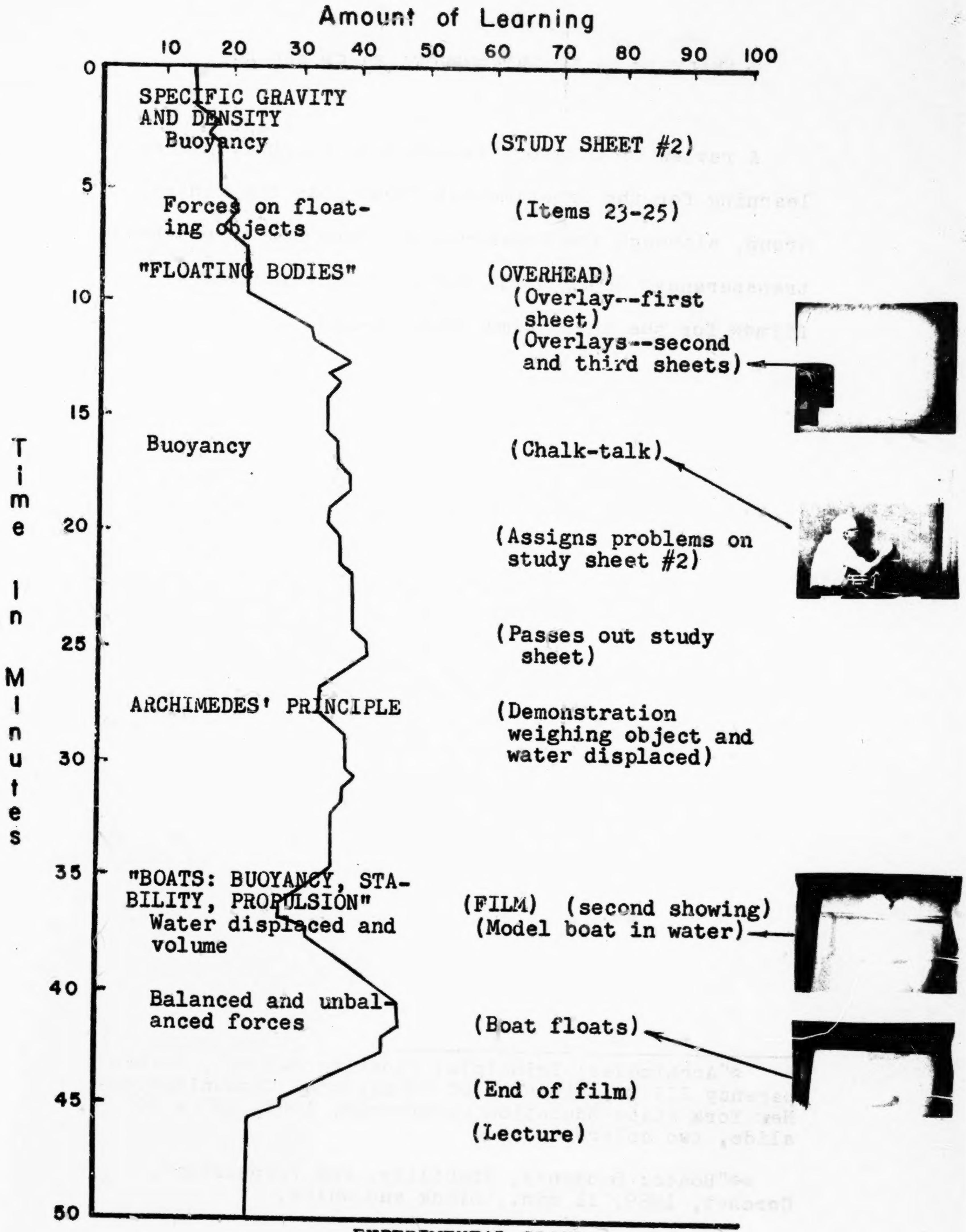
** "Archimedes' Principle: Floating Bodies", Transparency III. P., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.

40-44) when learning higher than when this principle was taken up at any time in the Control Group.



CONTROL GROUP

LEARNING PROFILE NUMBER 51



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 52

ANALYSIS OF LEARNING PROFILES 51 AND 52

A review of buoyancy resulted in slightly higher learning for the Experimental Group than the Control Group, although the Experimental Group saw an overhead transparency* (E52, 9-14) for a second time and a film** for the third time (E52, 36-43).

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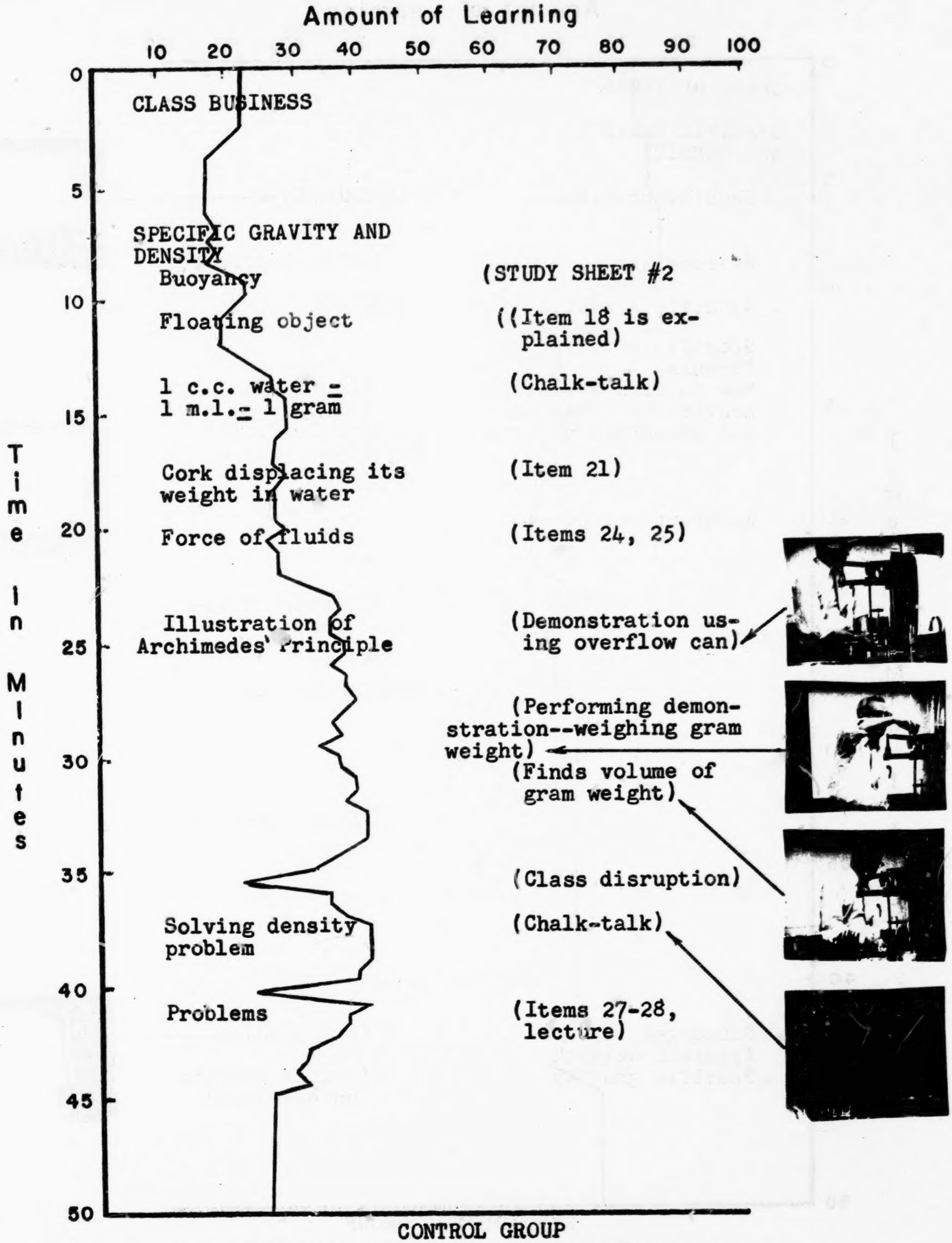
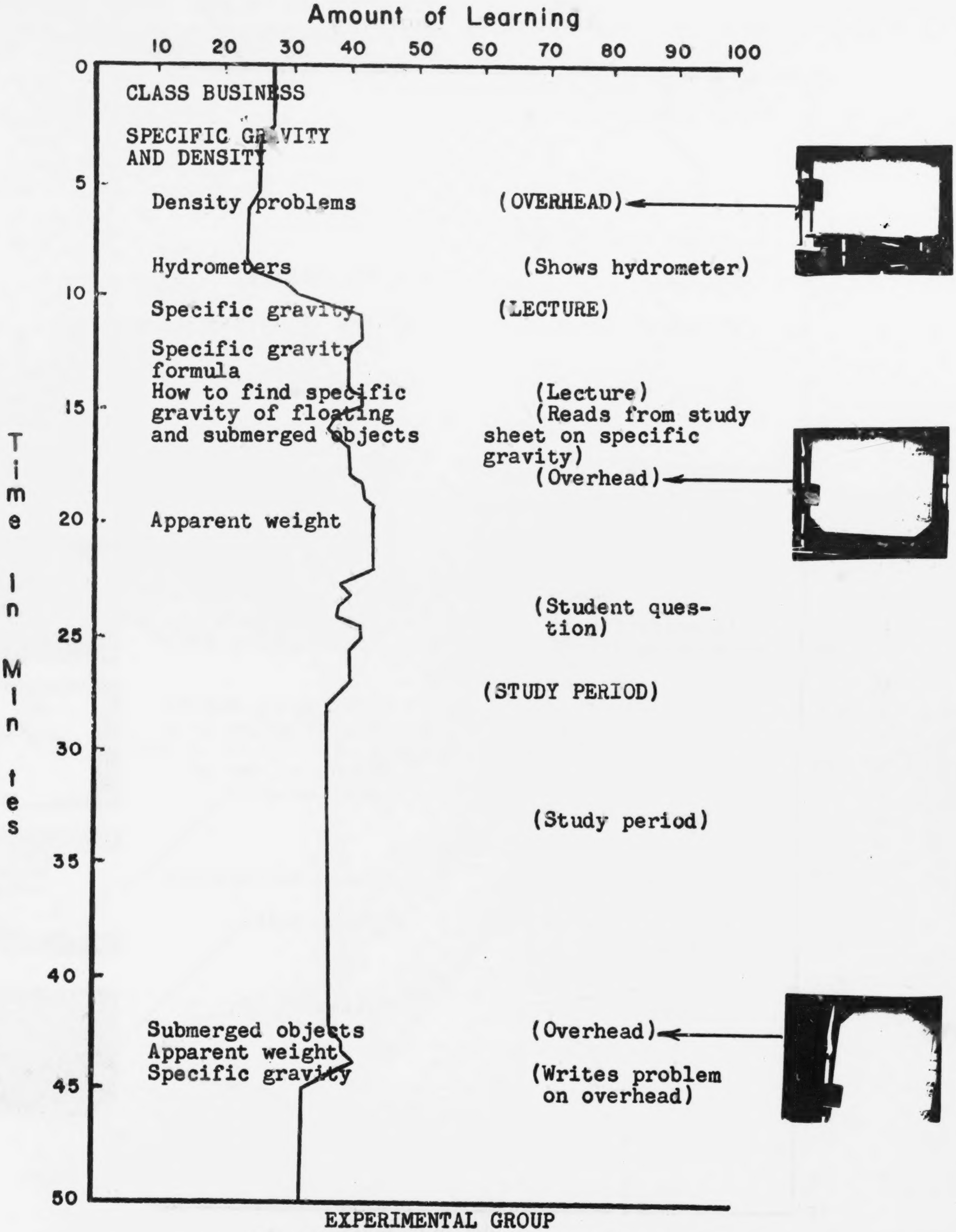
*"Archimedes' Principle: Floating Bodies", Transparency III P., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.

**"Boats: Buoyancy, Stability, and Propulsion", Coronet, 1959. 11 min., black and white.



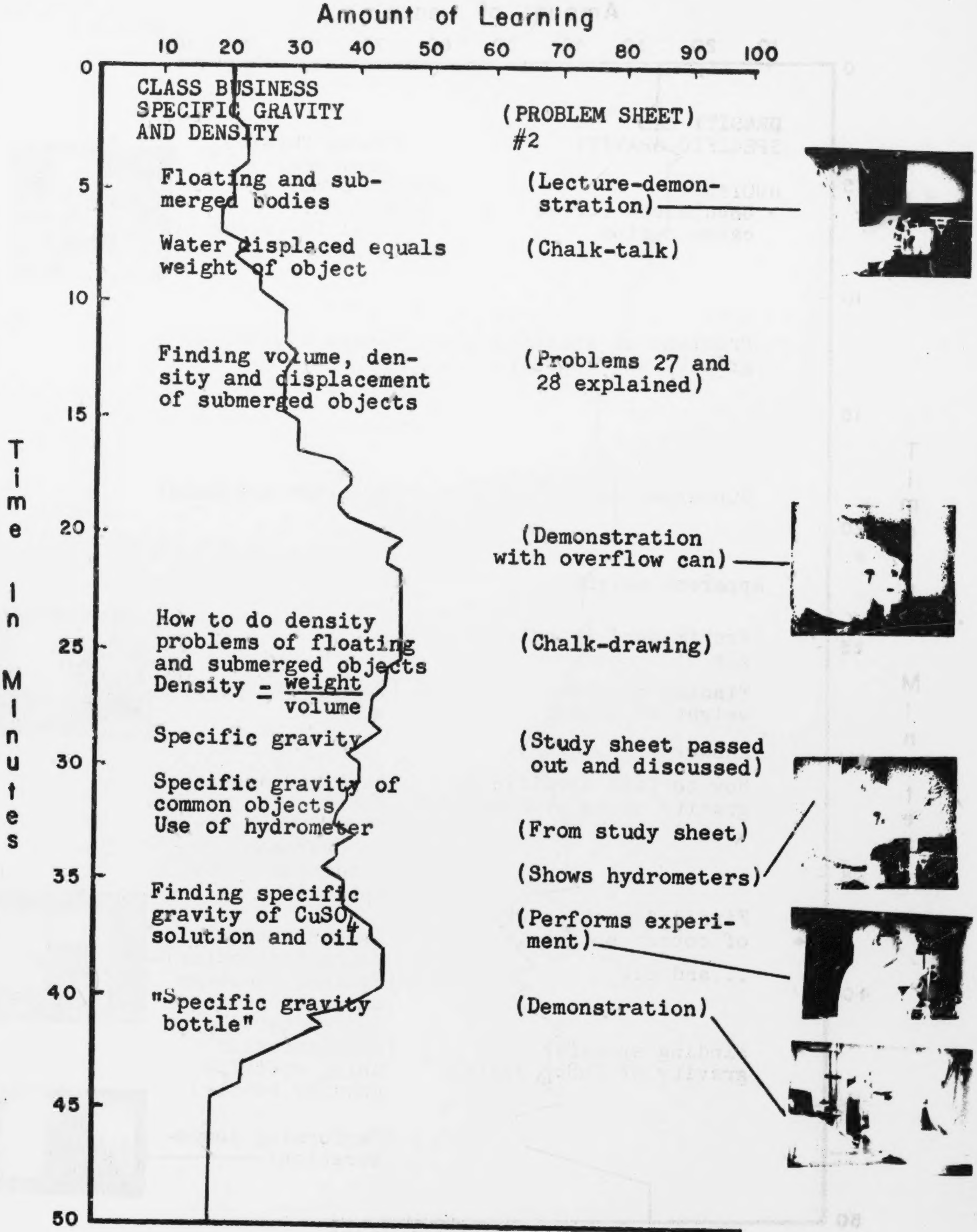
CONTROL GROUP

LEARNING PROFILE NUMBER 53



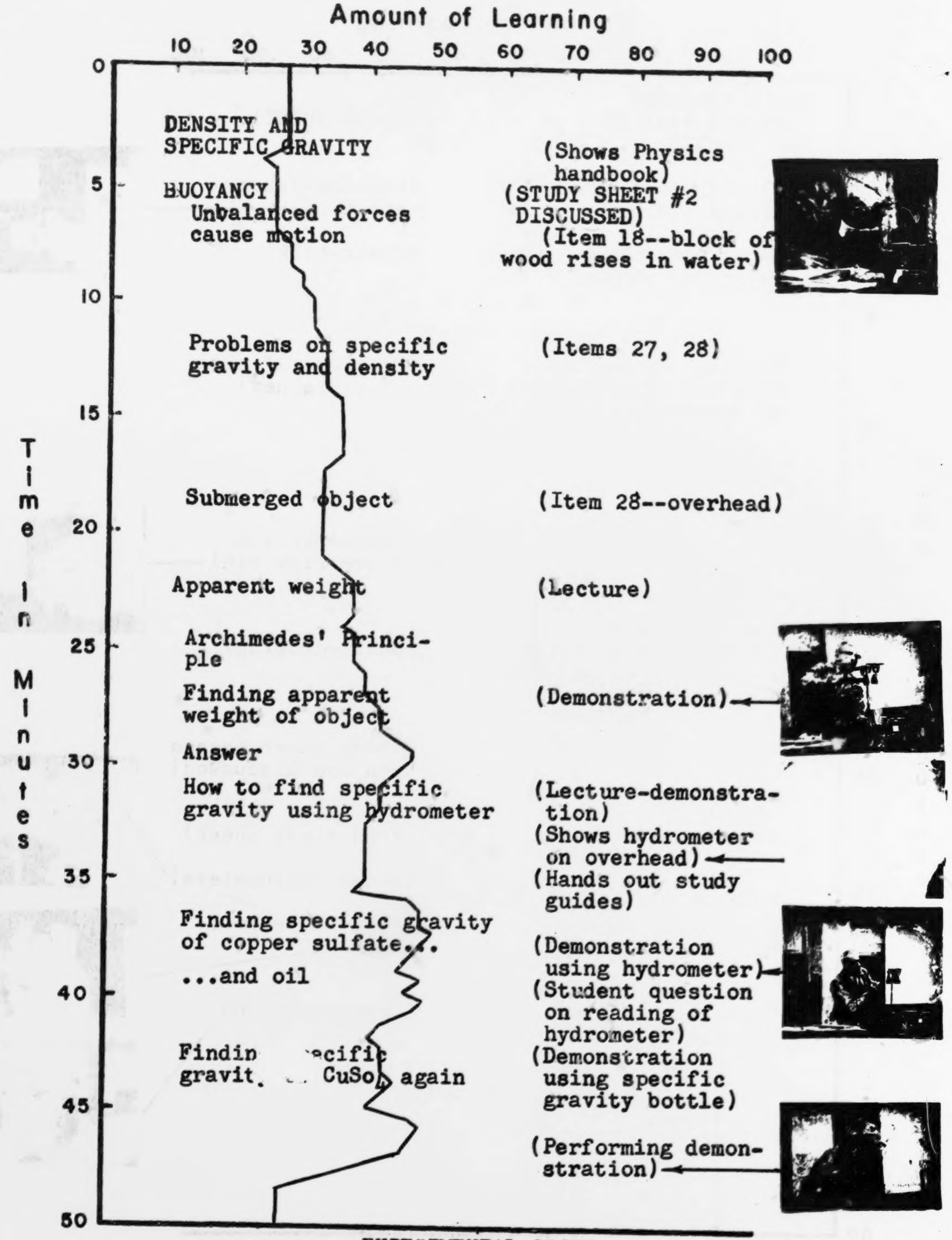
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 54



CONTROL GROUP

LEARNING PROFILE NUMBER 55



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 56

ANALYSIS OF LEARNING PROFILES 53, 54, 55 AND 56

Except for a brief showing of a transparency* listing problems (E54, 7), brief reference to a transparency** (E54, 18 and E56, 20) and a passing showing of a hydrometer without discussion (E54, 10), the Experimental Group received no communications media.

In the Control Group on both days (C53 and C55) there were active demonstrations and discussion of the answers to a study sheet which the students were later to turn in for consideration in receiving a report card grade in a day or two (C57, 2). Not all of these answers were takenup in the Experimental Group (E54 and E56) and not as much time was given to them.

In other respects the presentations in the classes were similar and the general levels of the profiles were relatively alike.

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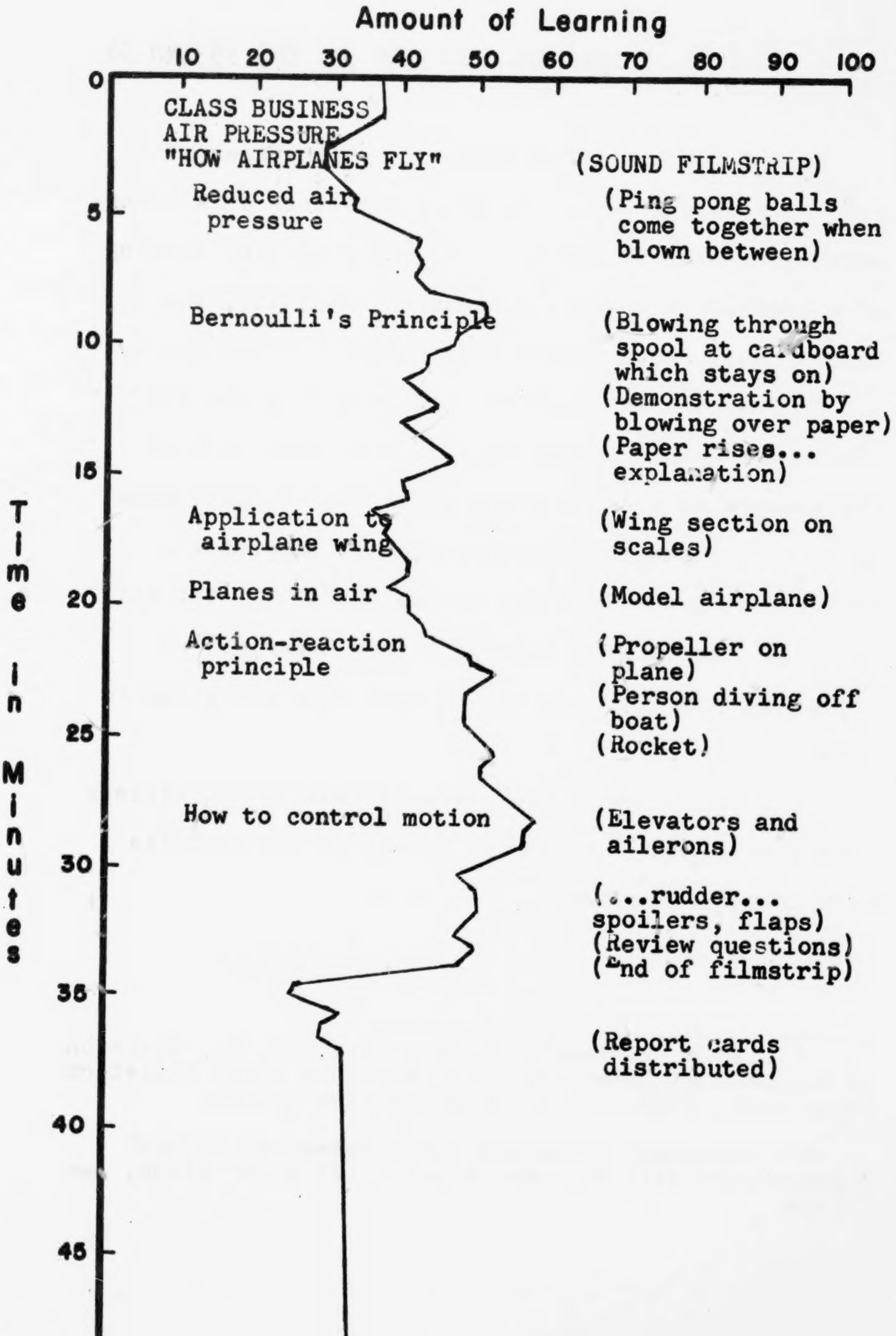
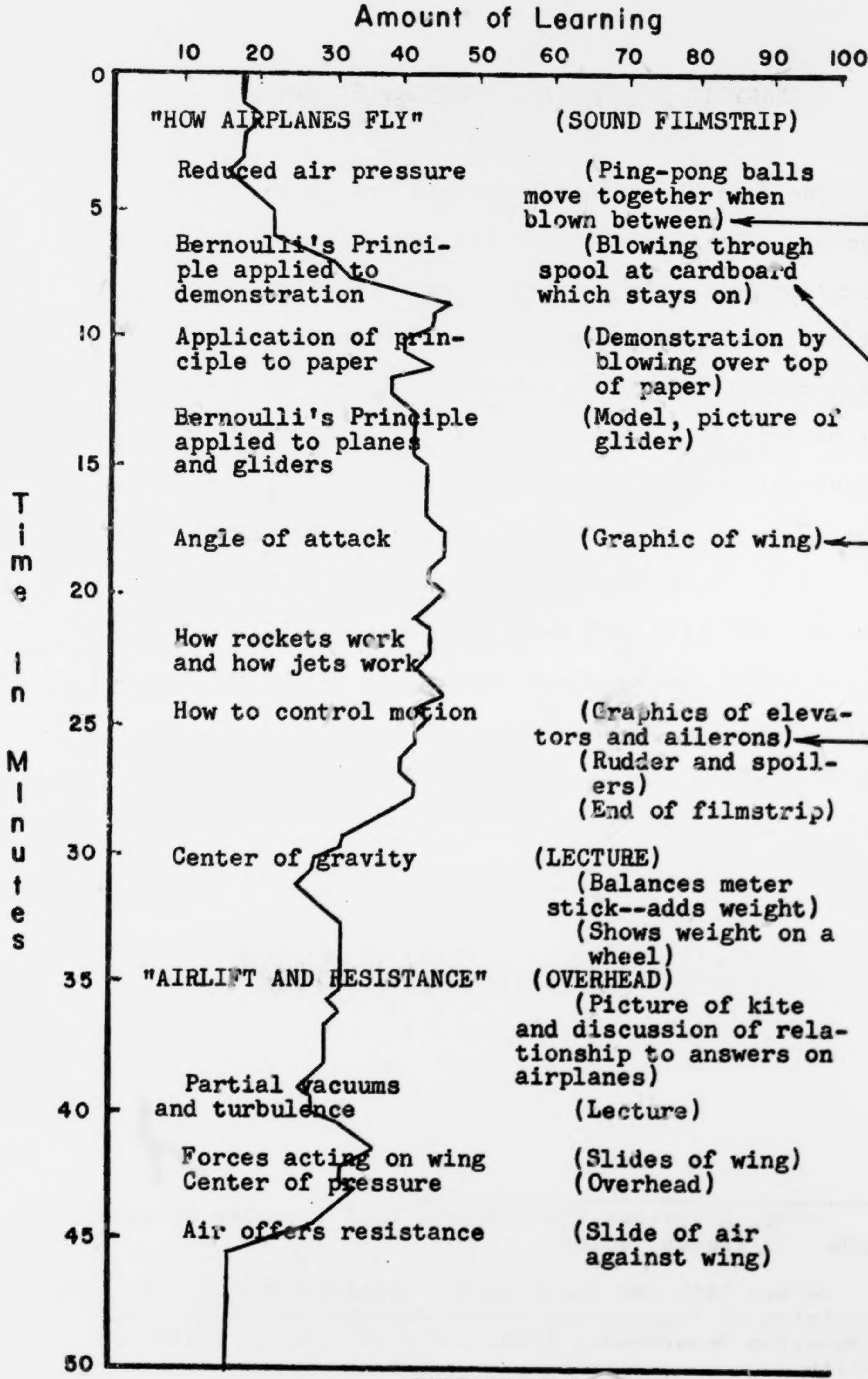
*"Density Problems", Transparency III. T., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.

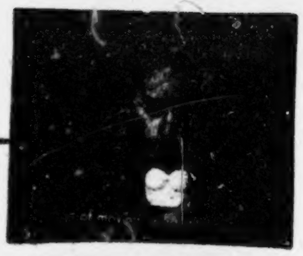
**"Archimedes' Principle for a Submerged Object" Transparency III, P., same source, 10" x 10" slide, two colors.

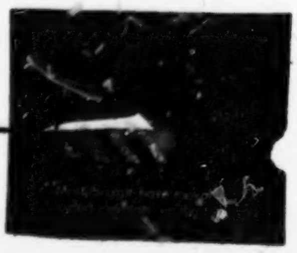


CONTROL GROUP

LEARNING PROFILE NUMBER 57







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 58

ANALYSIS OF LEARNING PROFILES 57 AND 58

The same sound filmstrip* was presented to both groups. The teacher taped his narration providing the sound prior to the presentations. Learning varied slightly but was generally the same for both groups. Both groups had a high point at the part of the sound filmstrip (C57, 9 and E58, 8). This showed that the identical material presented in an identical way, resulted in very similar learning in two different groups.

In the Experimental Group a review by overhead transparencies** gave learning of some significance considering the immediacy of the review and the speed with which the five transparencies were taken up (E58, 35-40).

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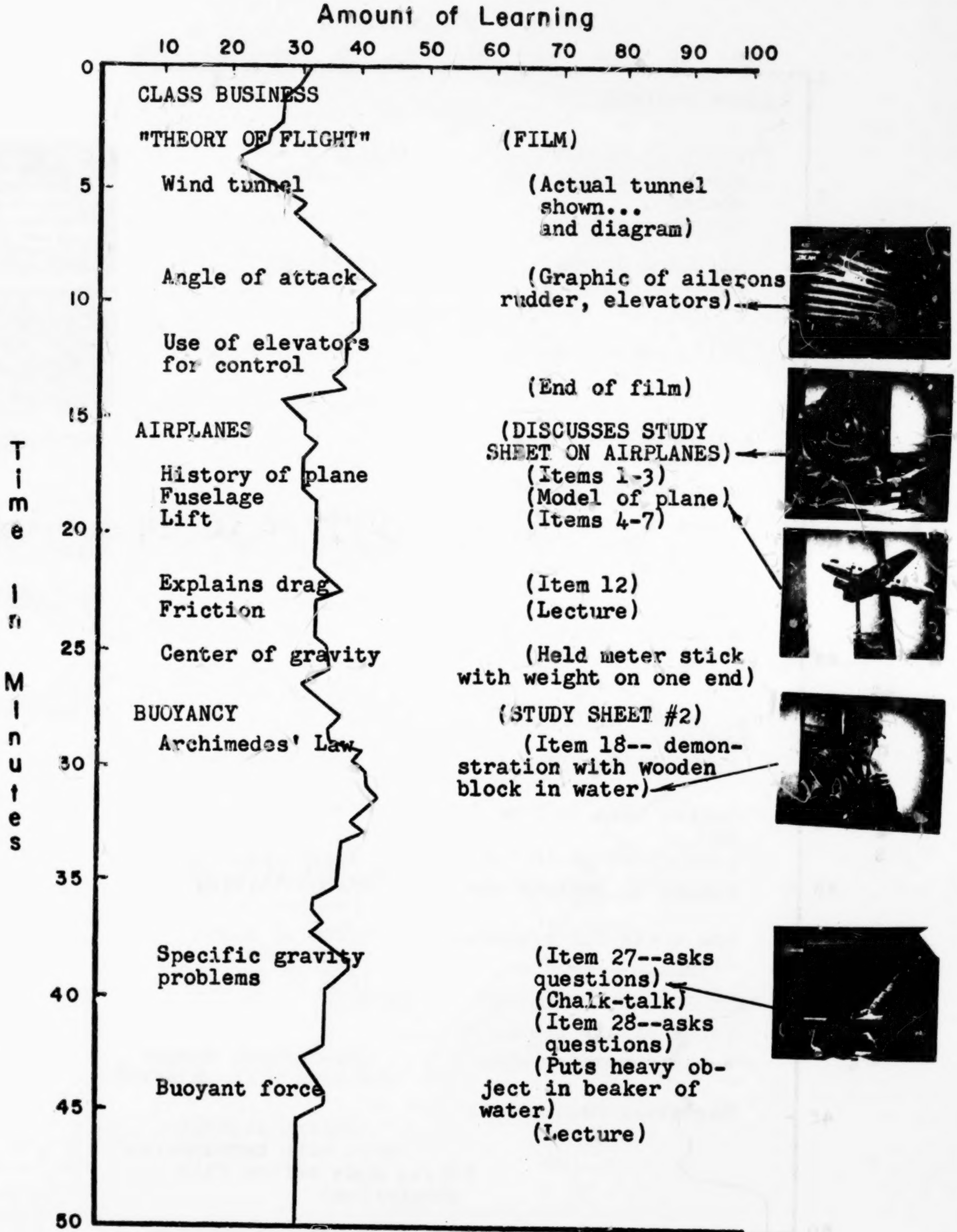
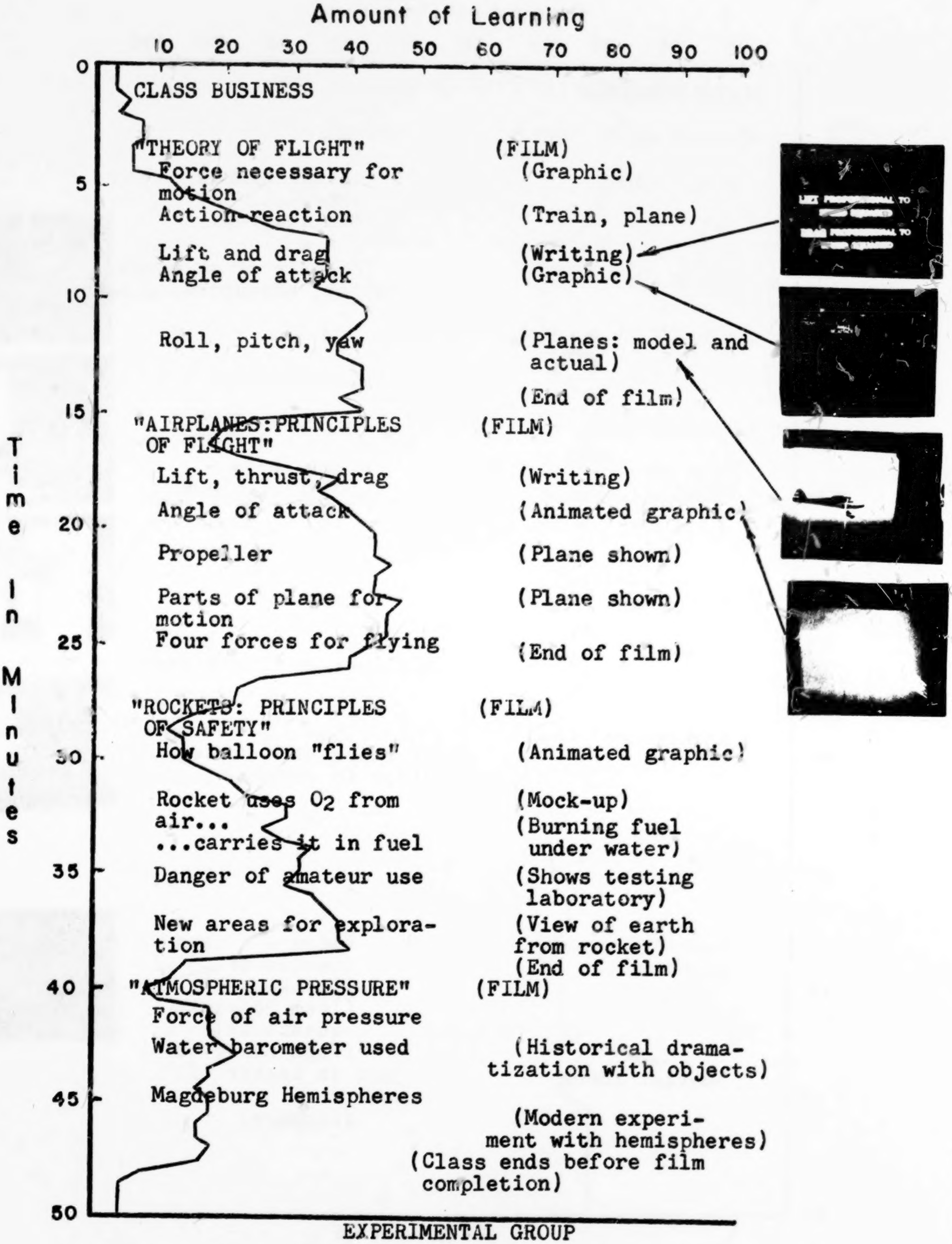
*"How Airplanes Fly", McGraw Hill (Popular Science), 1954, 39 frames, color.

**"Air Lift and Resistance", Transparency III. F. 1-5, Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 59



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 60

ANALYSIS OF LEARNING PROFILES 59 AND 60

Learning reached the same level when the same film* was shown in both the Control (C59, 3-14) and Experimental (E60, 3-14) Groups.

A film presentation on airplanes** resulted in higher learning (E60, 16-26) than a class discussion of answers to a sheet used as a guide for textbook study on airplanes (C59, 16-26). A list of questions to look for was placed on a flip chart by the screen

The last two films shown in the Experimental Group had been seen earlier in the year. More learning resulted from a film on rockets*** because it was more directly related to the topic at hand. The class did not learn as much from another review film# because the content had been covered by another film and it was not directly related to the current topic of study.

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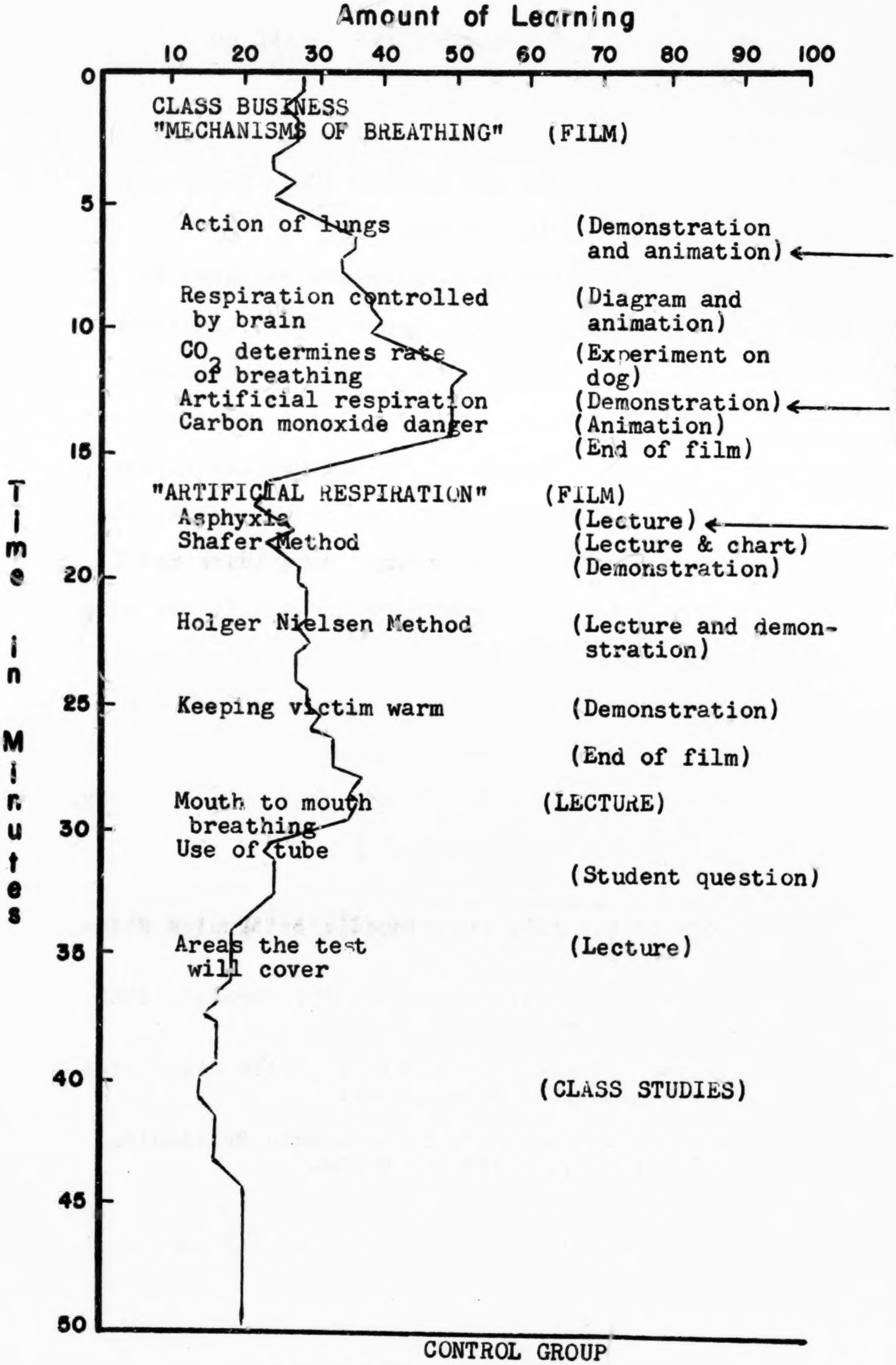
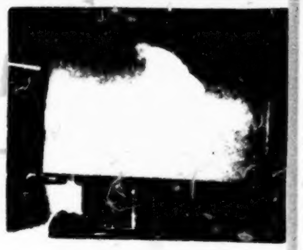
*"Theory of Flight", Encyclopedia Britannica Films, 1941, 11 min., black and white.

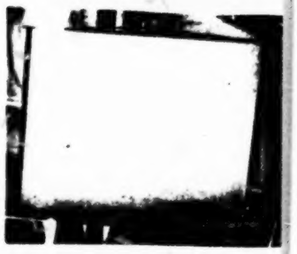
**"Airplanes: Principles of Flight", Coronet, 1960. 11 min., black and white.

***"Rockets: Principles and Safety", Film Associates of California, 1959. 11 min., color.

#"Atmospheric Pressure", Encyclopedia Britannica Films, 1955. 11 min., black and white.

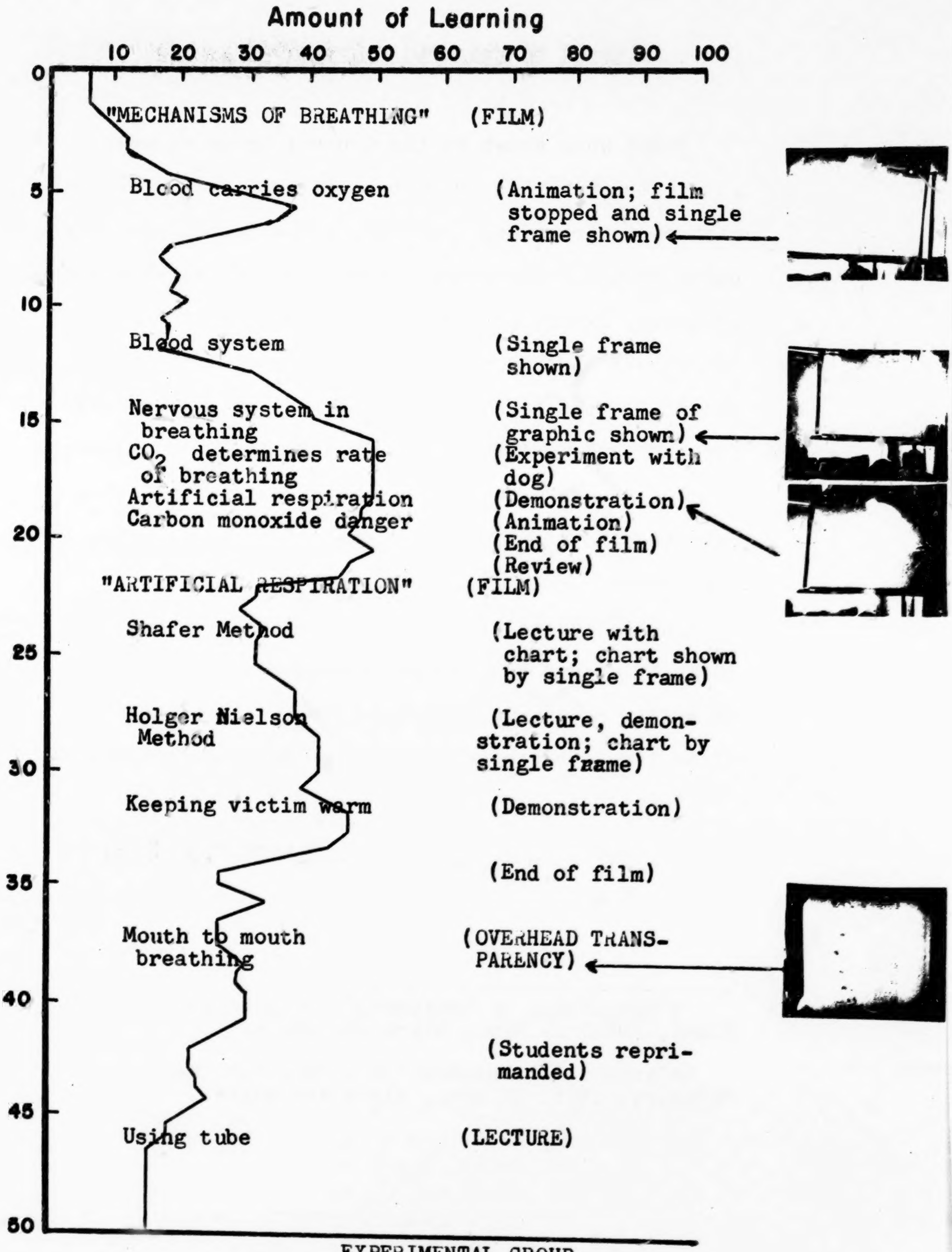






CONTROL GROUP

LEARNING PROFILE NUMBER 61



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 62

ANALYSIS OF LEARNING PROFILES 61 AND 62

Films were shown in the Control Group as well as the Experimental Group because they were a regular part of instruction. However, a new factor was introduced in the Experimental Group. The films were shown as usual, except at key parts the motion of the projector was stopped so that a single frame could be shown. In the first film* there was no general difference in learning (C61, 3-14 and E62, 3-20), except that which was made by showing a single frame which gave the Experimental Group (E62, 6) more learning than the Control Group (C62, 6).

In the second film** the students learned more (C61, 17-28 and E62, 23-35) throughout the film. In this film motion was stopped to show charts and to allow time for students to grasp what had preceded.

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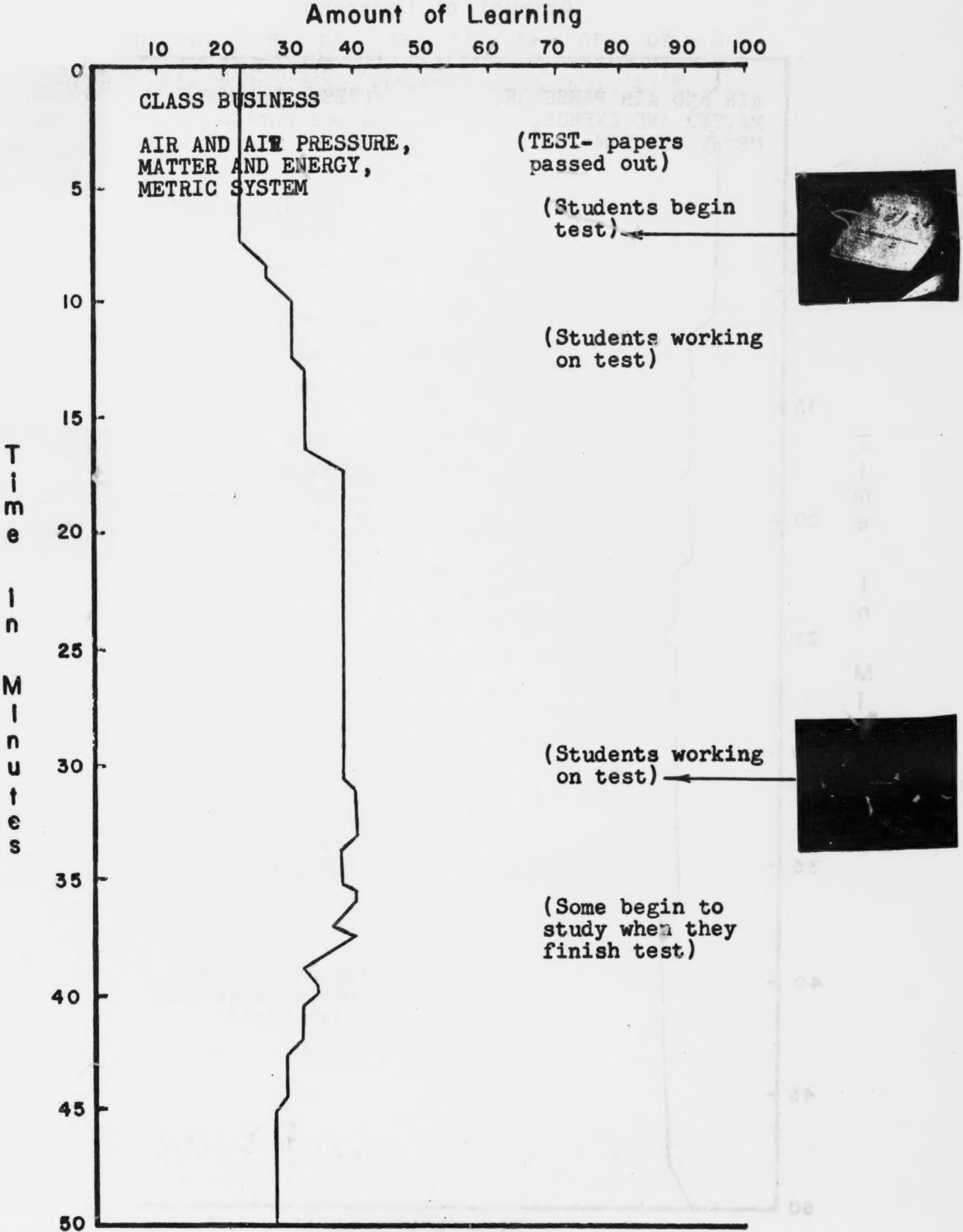
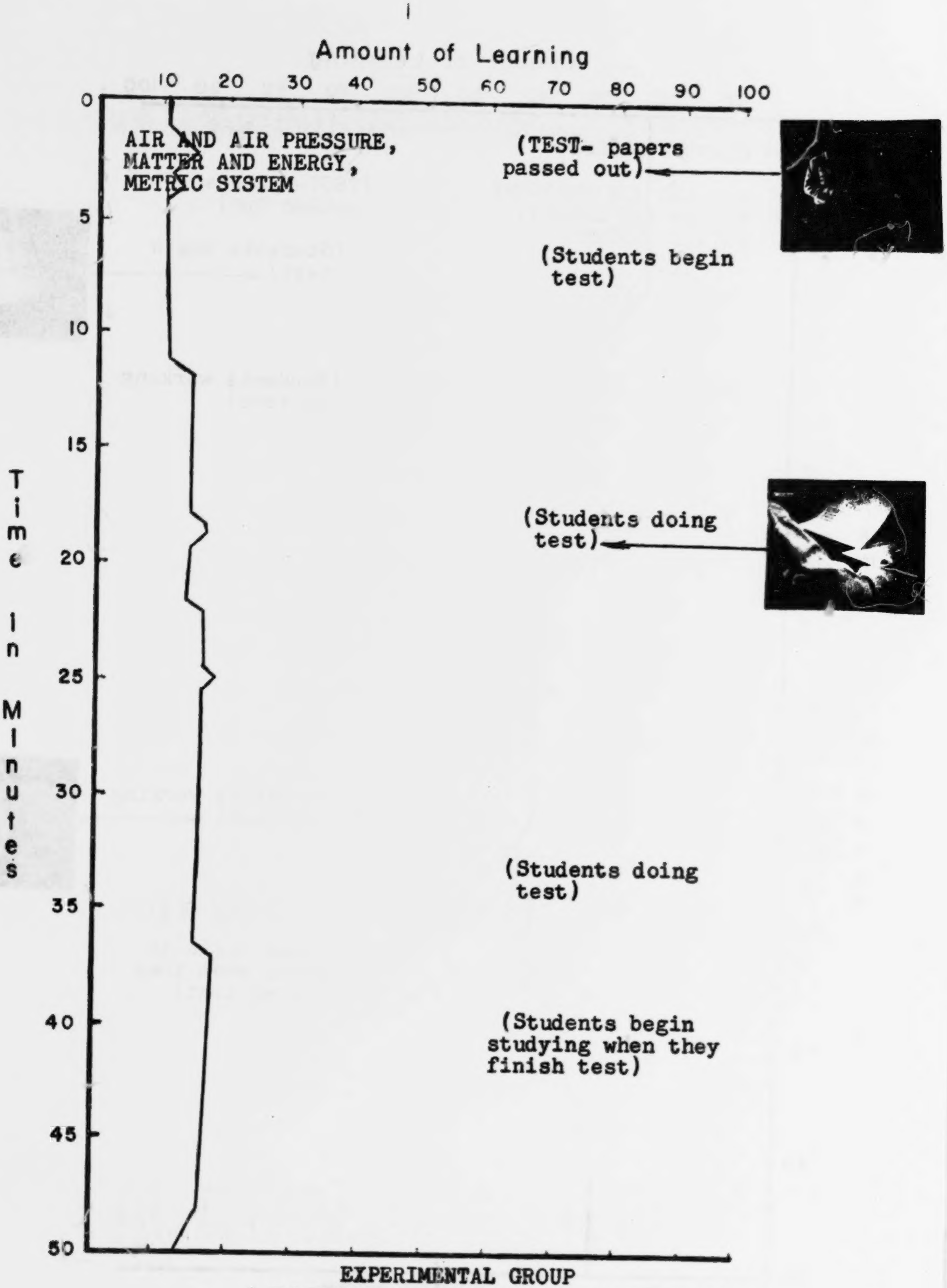
*"Mechanisms of Breathing", Encyclopedia Britannica Films, 1954. 11 min., black and white.

**"Artificial Respiration", Imperial Chemical Industry, 1956. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 63

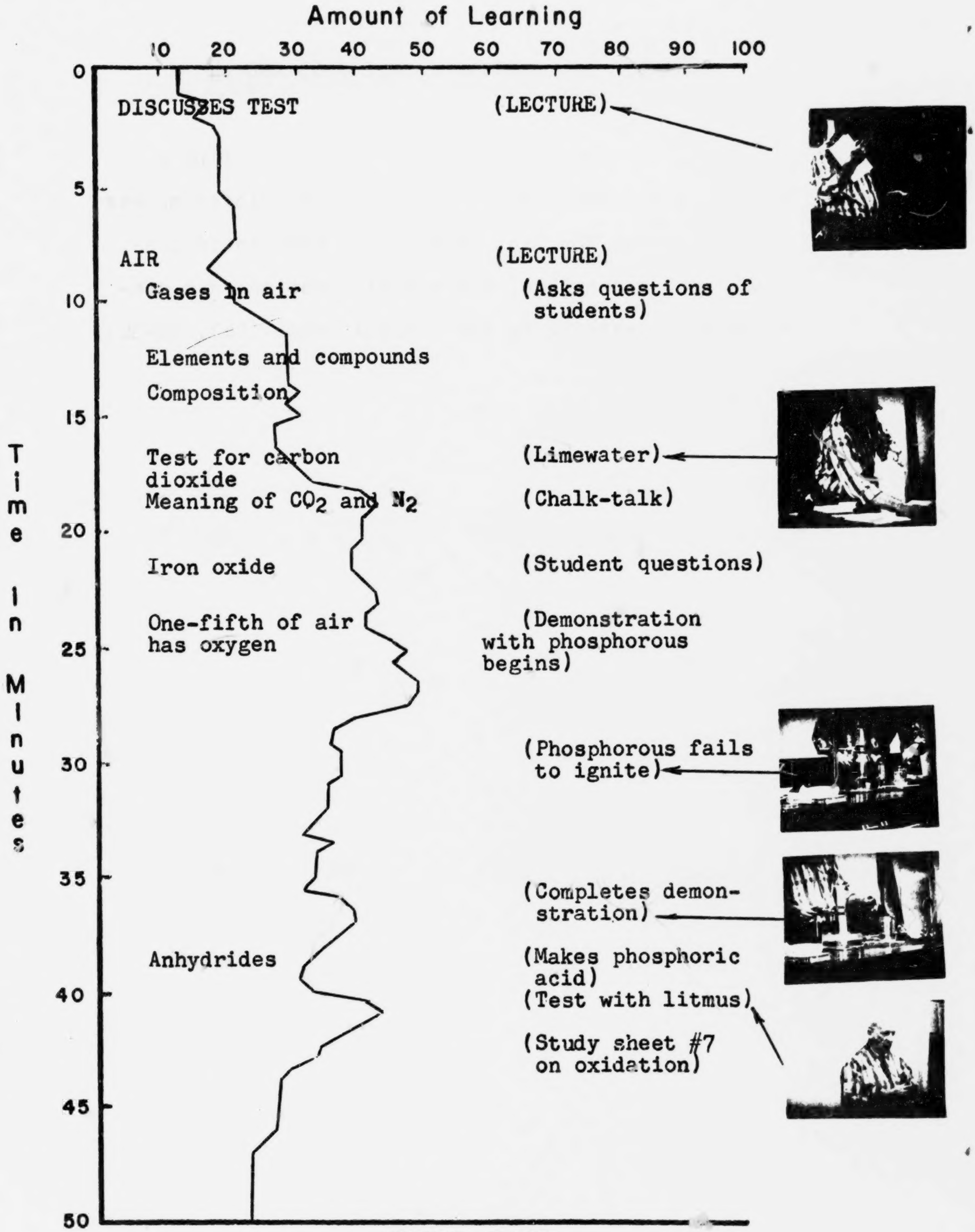


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 64

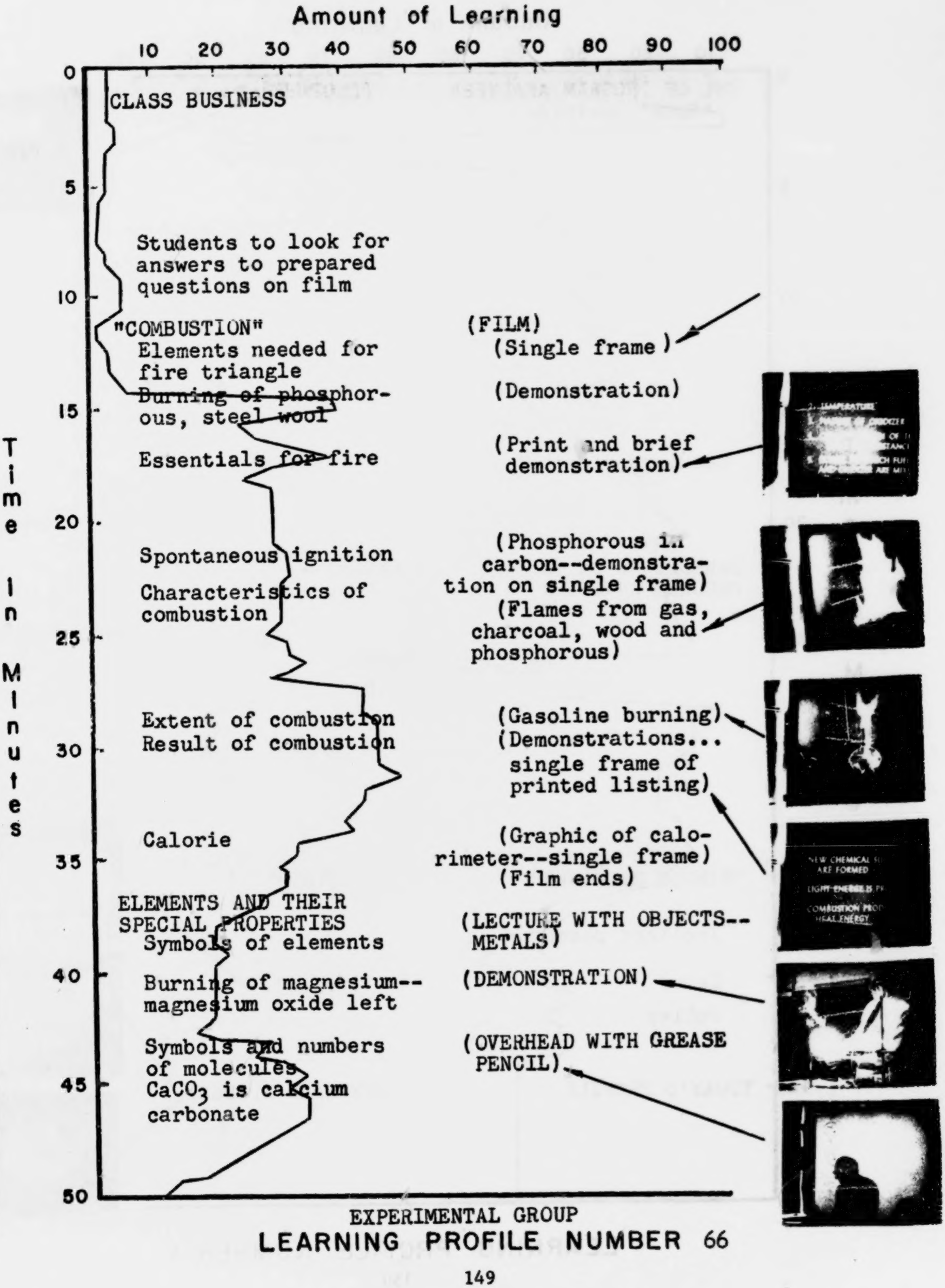
ANALYSIS OF LEARNING PROFILES 63 AND 64

Again the Control Group learned more during a test than the Experimental Group. Since learning was greater during the last part of the test as in previous test situations, the visual questions did contribute to learning by the Control Group (C63, 18-34).



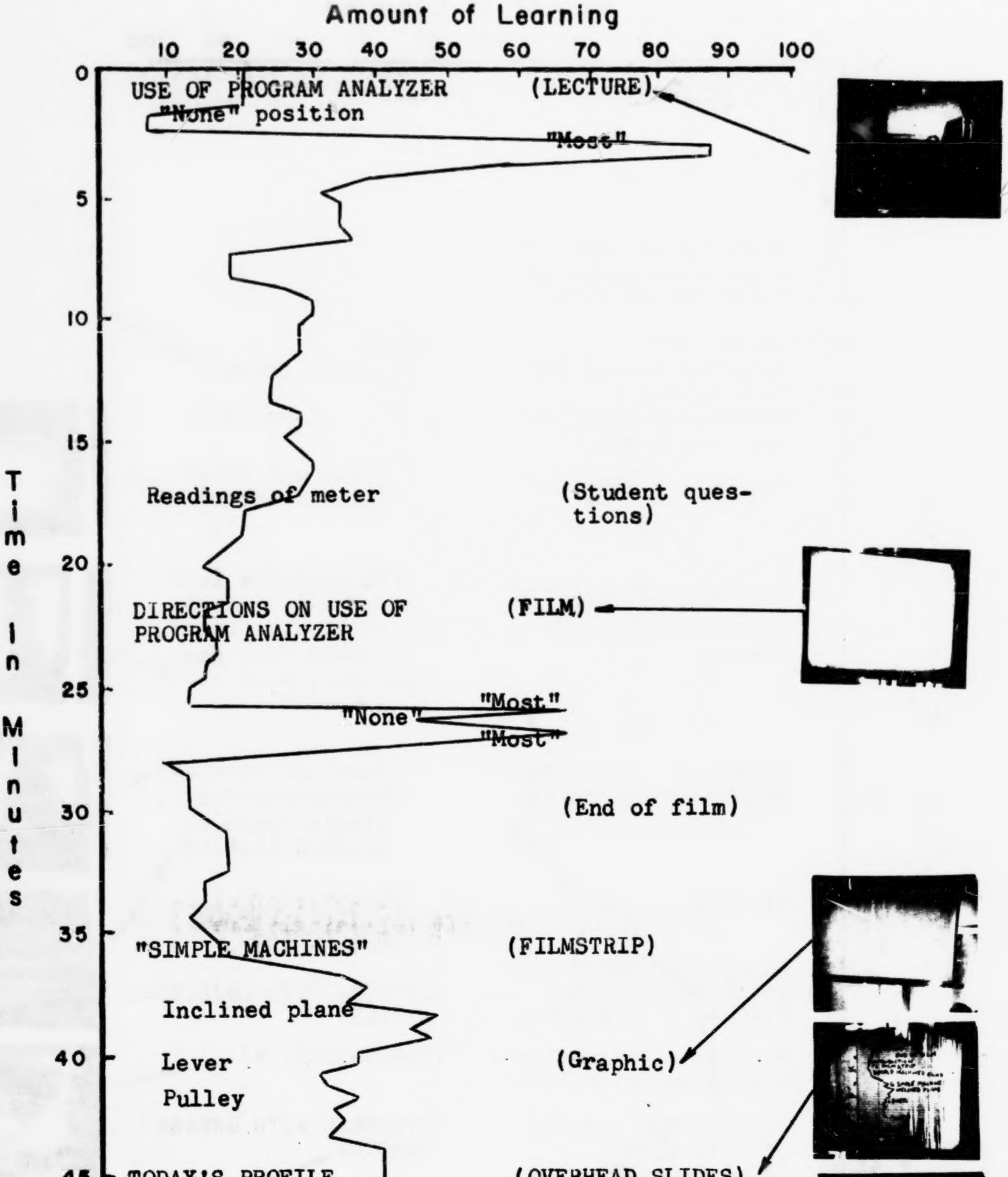
CONTROL GROUP

LEARNING PROFILE NUMBER 65

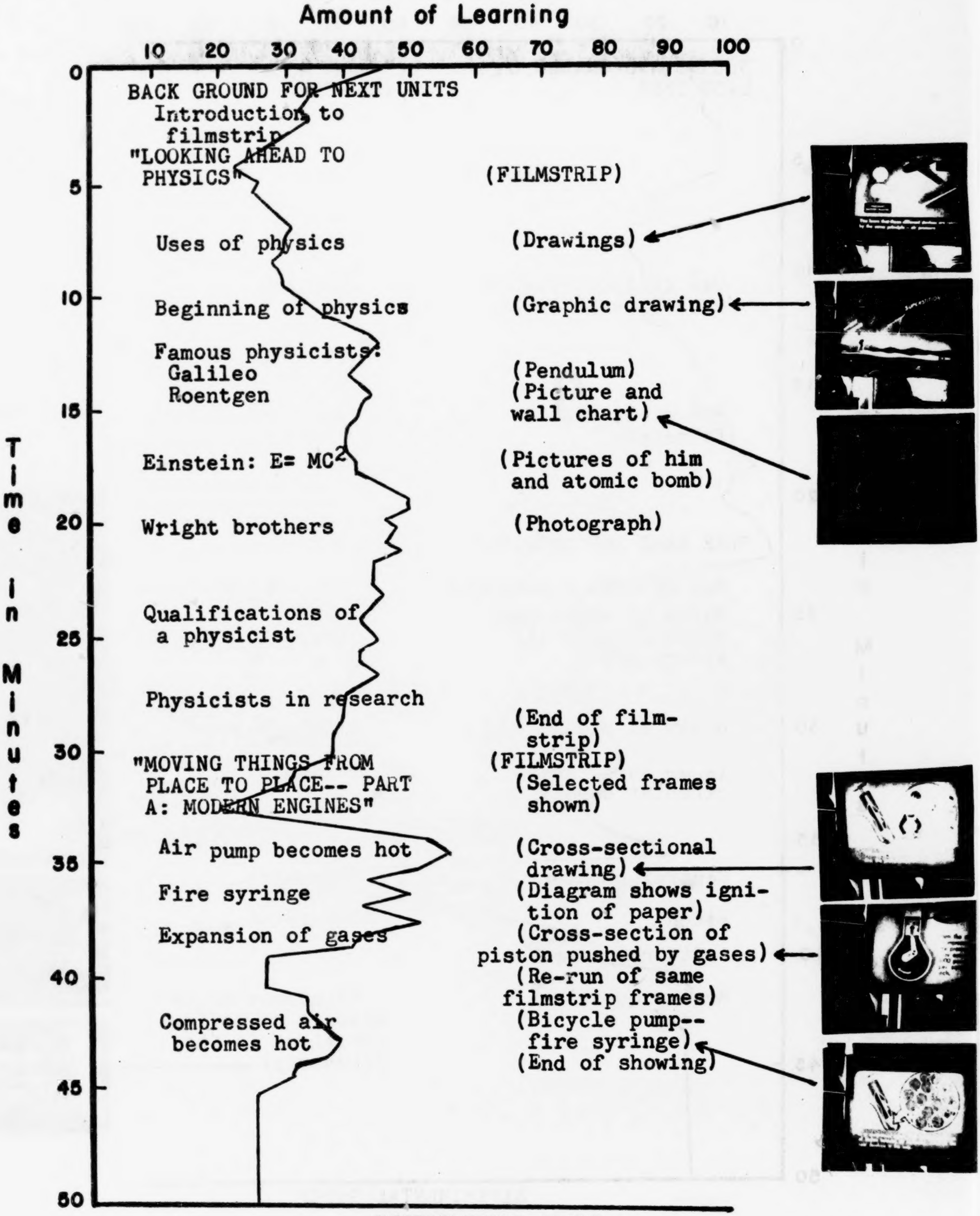


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 66

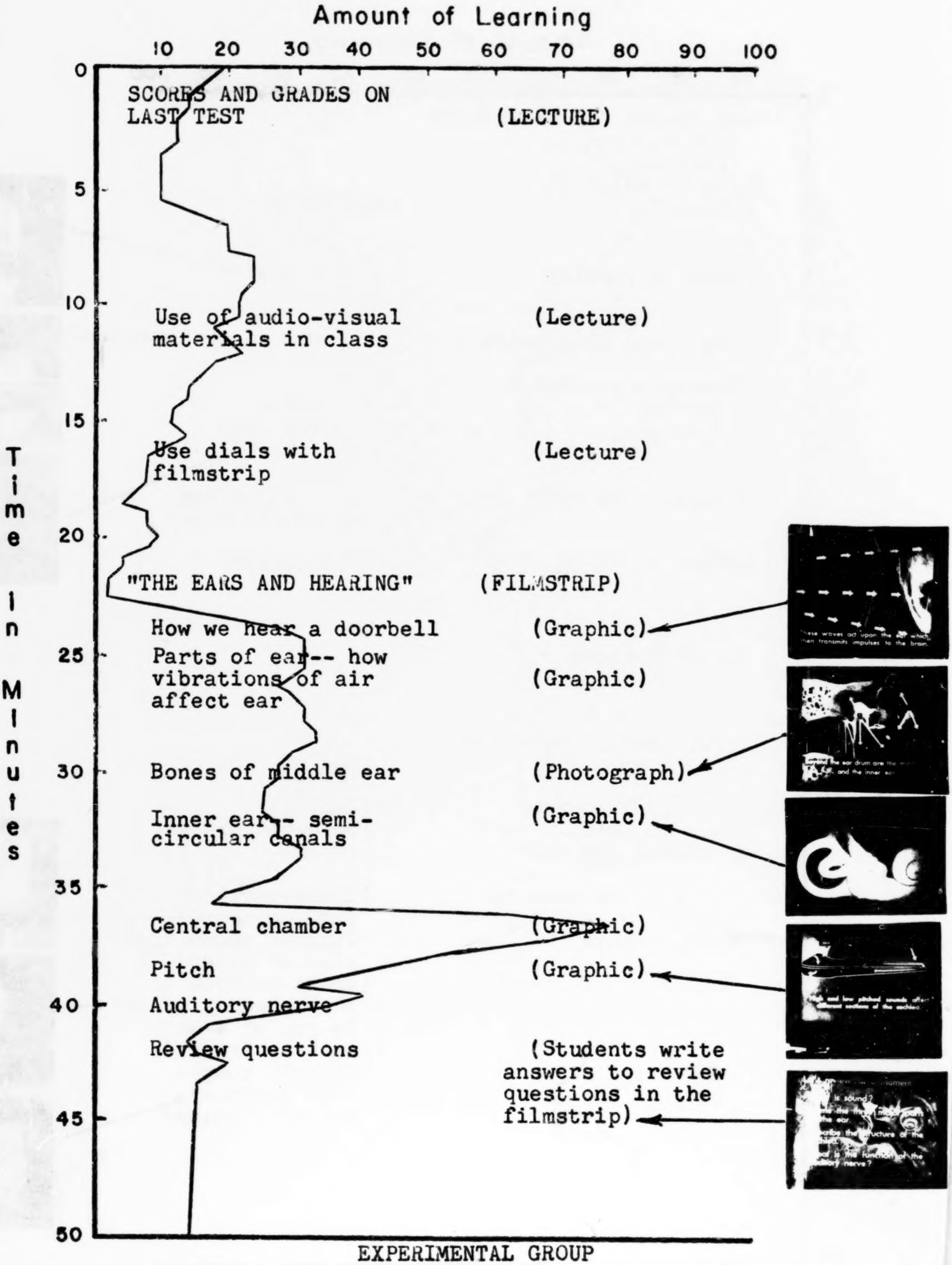


LEARNING PROFILE NUMBER A



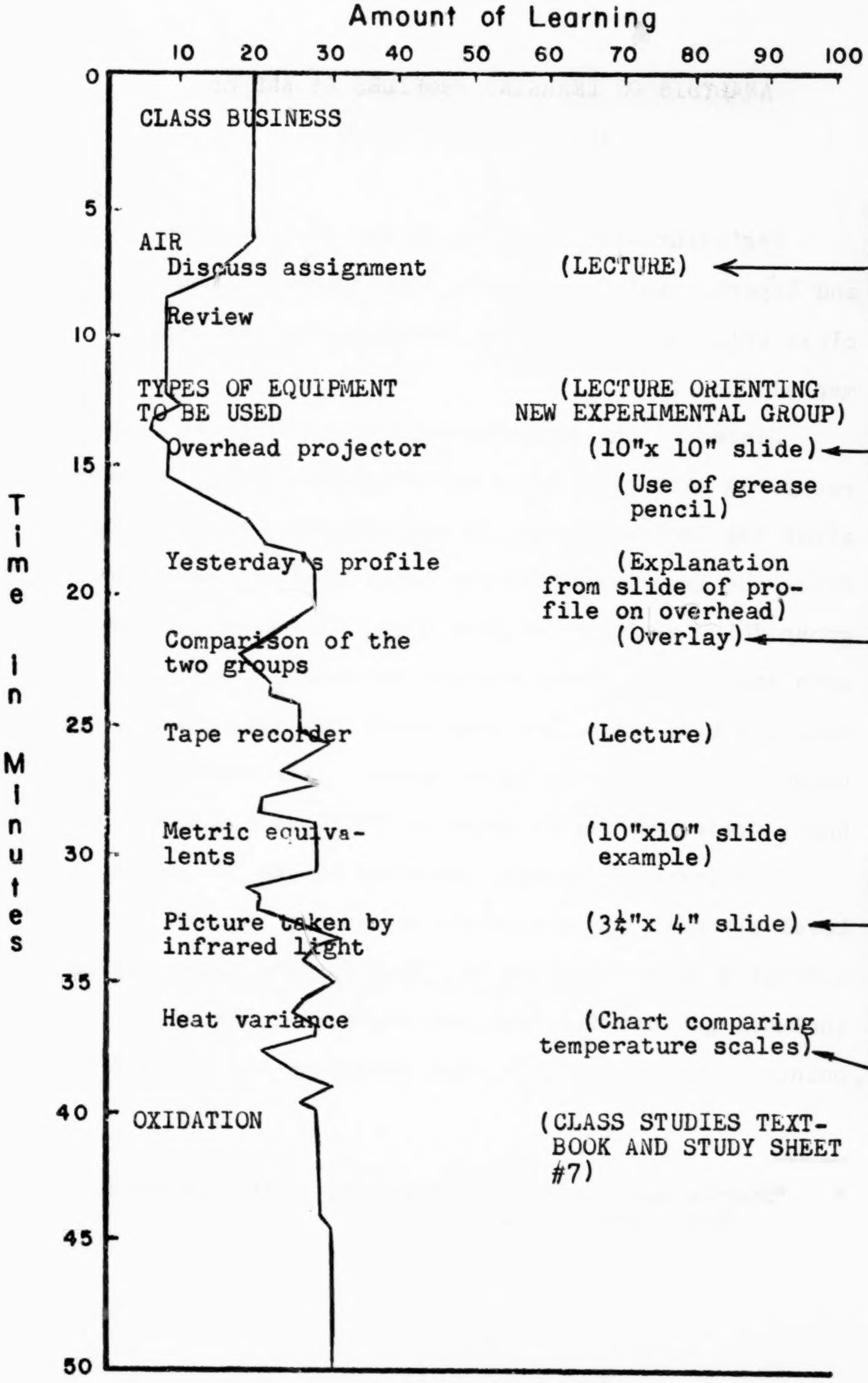
EXPERIMENTAL GROUP

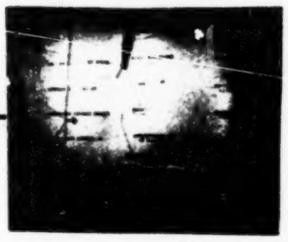
LEARNING PROFILE NUMBER B

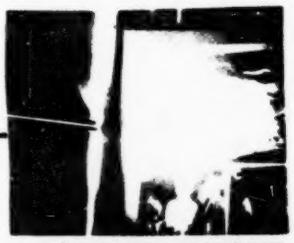


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER C







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER D

ANALYSIS OF LEARNING PROFILES 65 AND 66

ALSO A, B, C, AND D

Beginning with profiles 65 and 66, the Control and Experimental Groups were interchanged; thus the class which was the Control Group became the Experimental Group.

Since the new Experimental Group needed to begin receiving each particular day's subject matter content after the Control Group, it was necessary to delay it. Since the Experimental Group could not be a deprived group doing nothing for four days, they were presented with some of the instructional materials which were supplementary and which time would not have allowed presentation fully in later units. Learning during these presentations is shown in Profiles A,B,C and D.

A filmstrip* brought learning to the 50 percent level although the presentation was not related to current studies (Profile EA, 36-43). The presentation included graphic diagrams and drawings. The high points of two filmstrips, one orienting the student to the field of physics** and the other on engines*** (EB, 18 and EB, 34), were also on frames made by drawings.

---

* "Simple Machines", Row-Peterson, 1950. 56 frames, black and white.

In another filmstrip# an unusally high point was on a graphic drawing with arrows and labels to indicate important parts and functions (EC, 37).

In the Control Group a demonstration with phosphorous was given (C65, 25-37) resulting in higher learning than in the Experimental Group where a similar demonstration was given by a film## (E66, 20-22). In spite of lower learning in the Experimental Group, there was learning at a significant level and this learning took two minutes in contrast to twelve minutes in the Control Group.

The same demonstration was conducted by the teacher in the Experimental Group on another day (E70, 10-16) with the addition of overhead transparencies stating the principle being shown by the demonstration. Again, although learning was lower in the Experimental Group,

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** "Looking Ahead to Physics", Scribner's Sons, 1958. 46 frames, color.

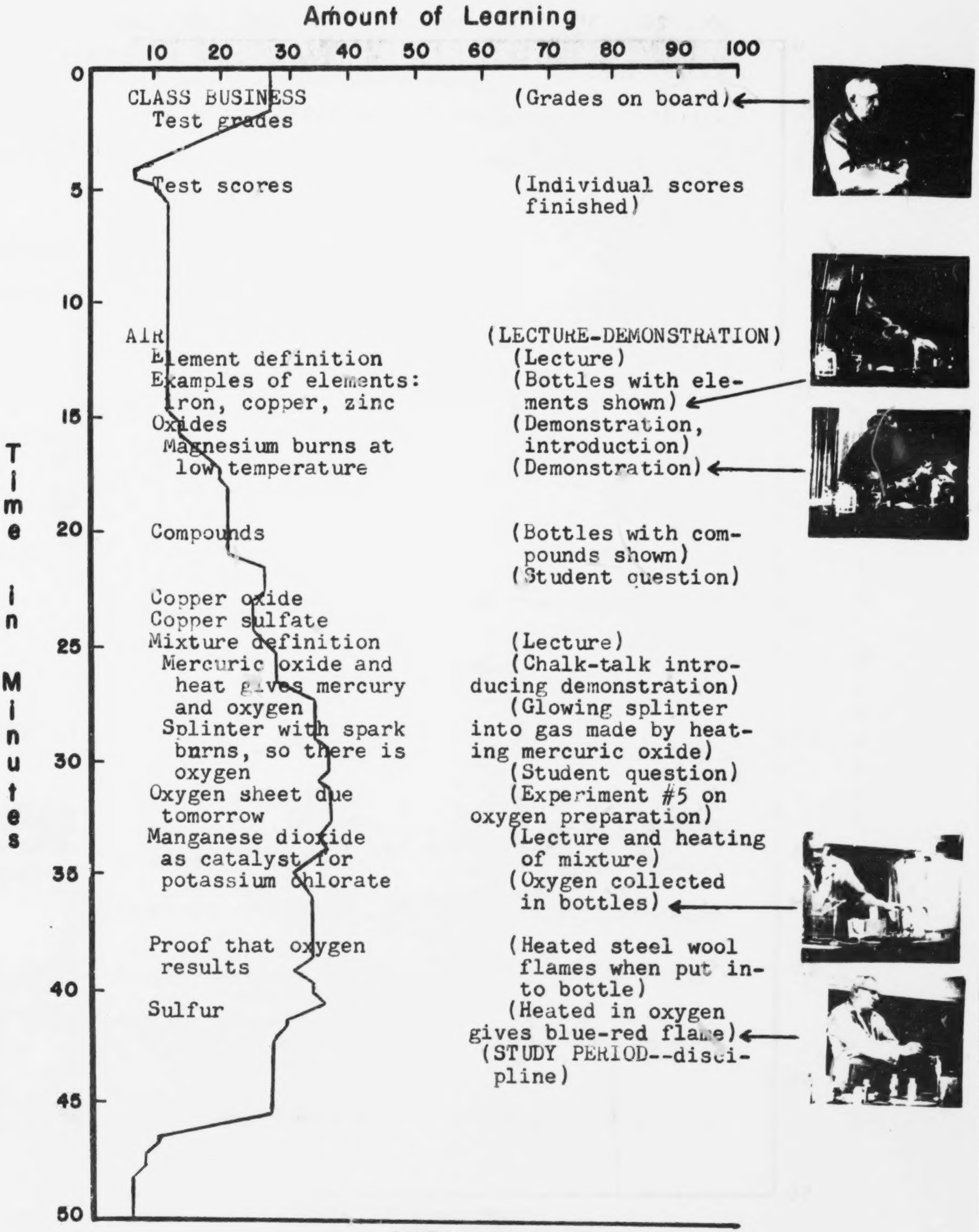
*** "Moving Things from Place to Place--Part A:Modern Engines", Scribner's Sons, 1954. 26 frames, color.

# "The Ears and Hearing", Encyclopedia Britannica Films, 1949. 11 min., black and white.

## "Combustion", Sutherland, 1958. 15 min., color.

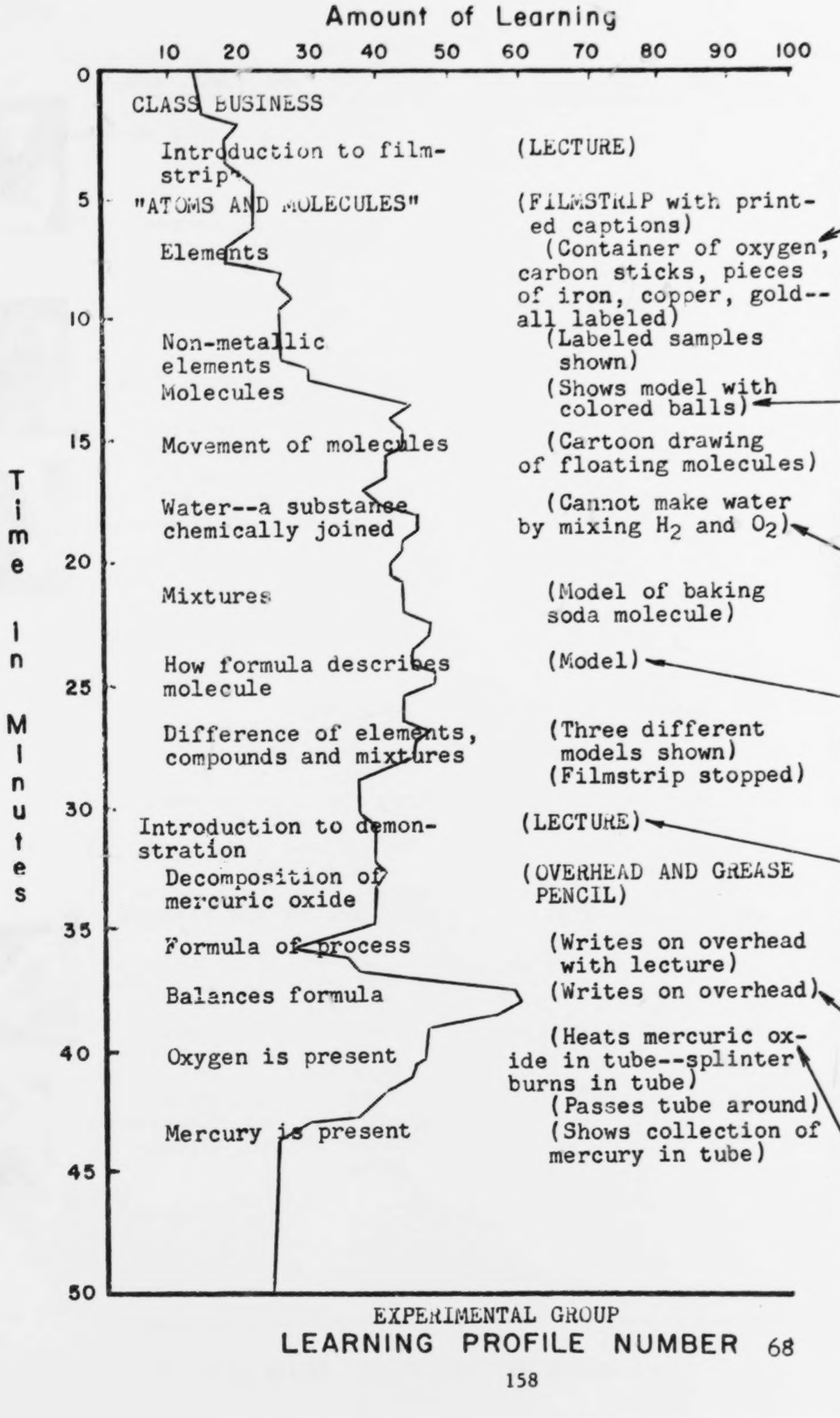
it took half the time as in the Control Group which did not have the overhead transparencies to place the scientific principles clearly before them.

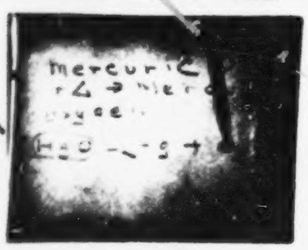
The use of the grease pencil on the overhead projector (E66, 43-47) resulted in greater learning than lecture (C65, 11-15).

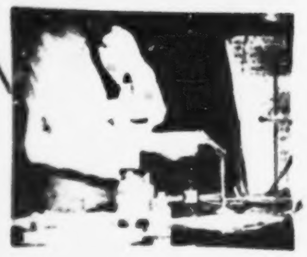


CONTROL GROUP

LEARNING PROFILE NUMBER 67







EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 68

ANALYSIS OF LEARNING PROFILES 67 AND 68

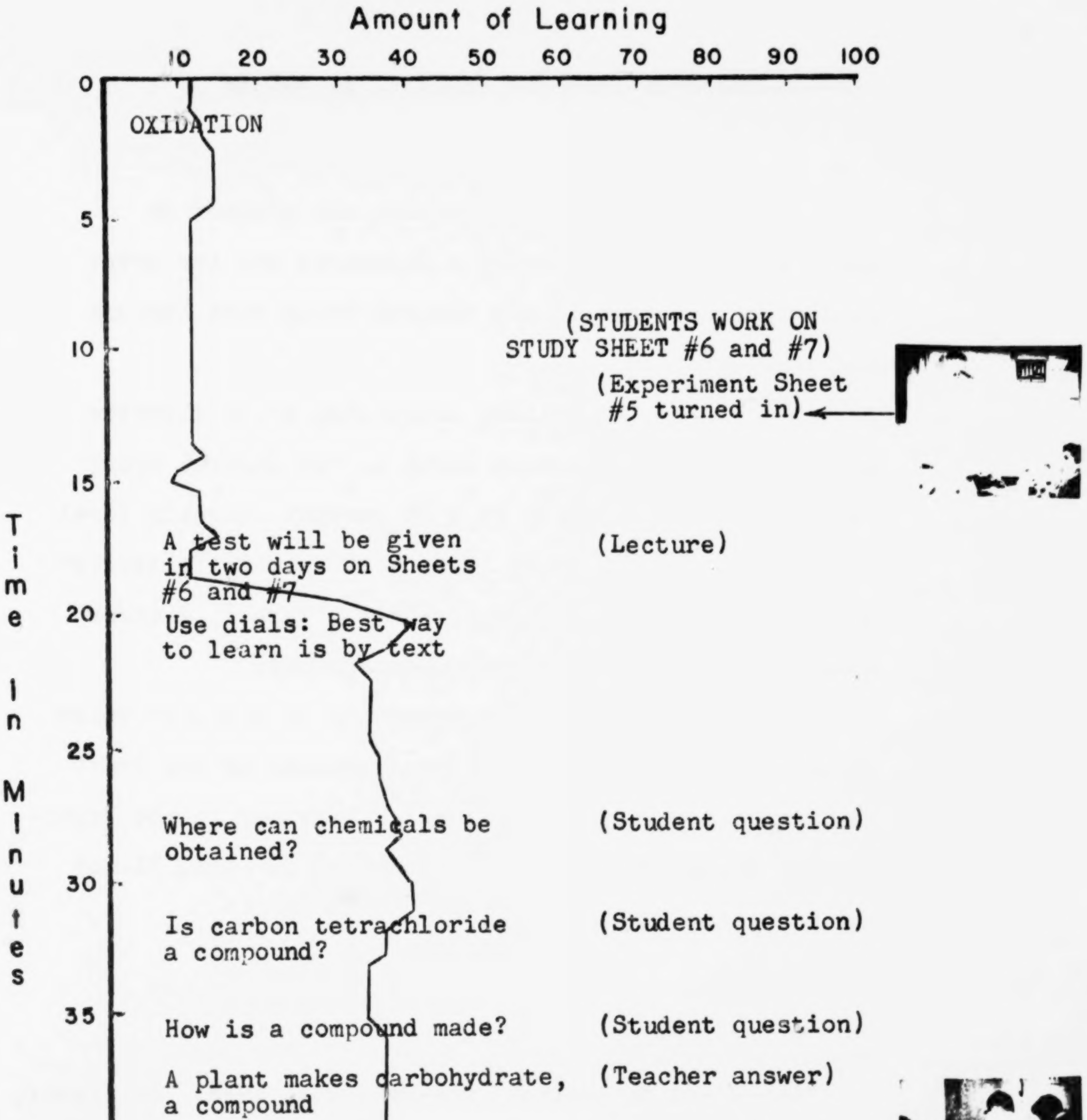
The general level of learning was greater in the Experimental Group with a filmstrip and the overhead projector than in the Control Group with lecture and demonstration.

A lecture with bottles containing metal elements gave a 10 percent learning level in the Control Group (C67, 13-15) as compared to a 28 percent learning level in the Experimental Group (E68, 8-10) with a filmstrip* presenting the same information but a larger, clearer view of the elements by color photography.

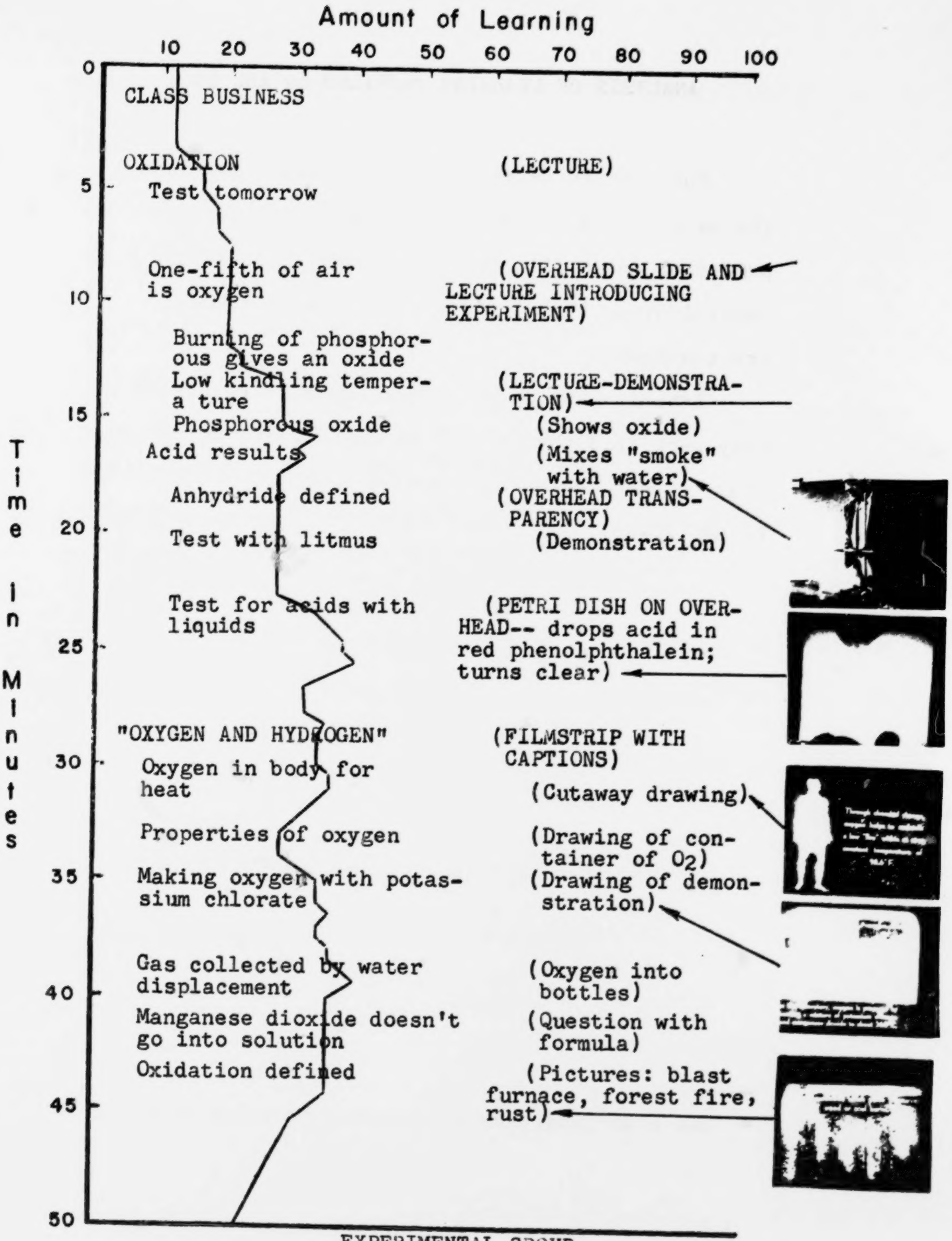
A demonstration of decomposition of mercuric oxide accompanied by grease pencil explanations on the overhead projector resulted in greater learning in the Experimental Group (C67, 25-40 as compared to E68, 31-44) and took less time.

---

* "Atoms and Molecules", Row-Peterson, 1958. 46 frames, color.



CONTROL GROUP
LEARNING PROFILE NUMBER 69



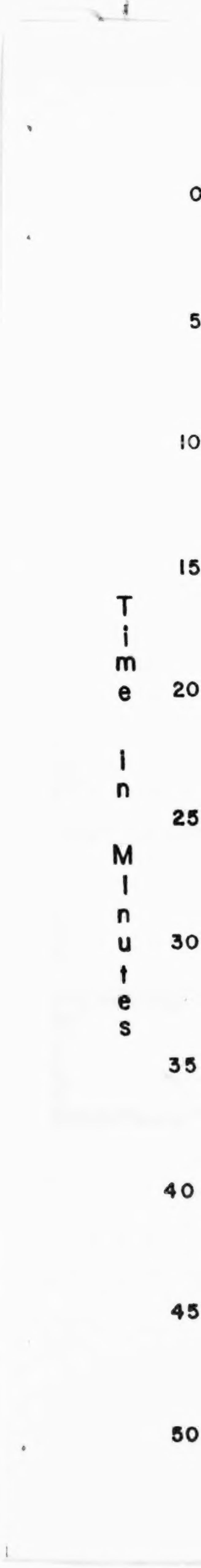
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 70

ANALYSIS OF LEARNING PROFILES 69 AND 70*

The average level of learning was higher in the Experimental Group (E 70) where the overhead projector and a filmstrip were used, than in the Control Group (C 69) where the students studied the textbook.

Learning increased in the Control Group when they were told that a test would be given on the study sheets designed to assist textbook study (C 69, 20-45).



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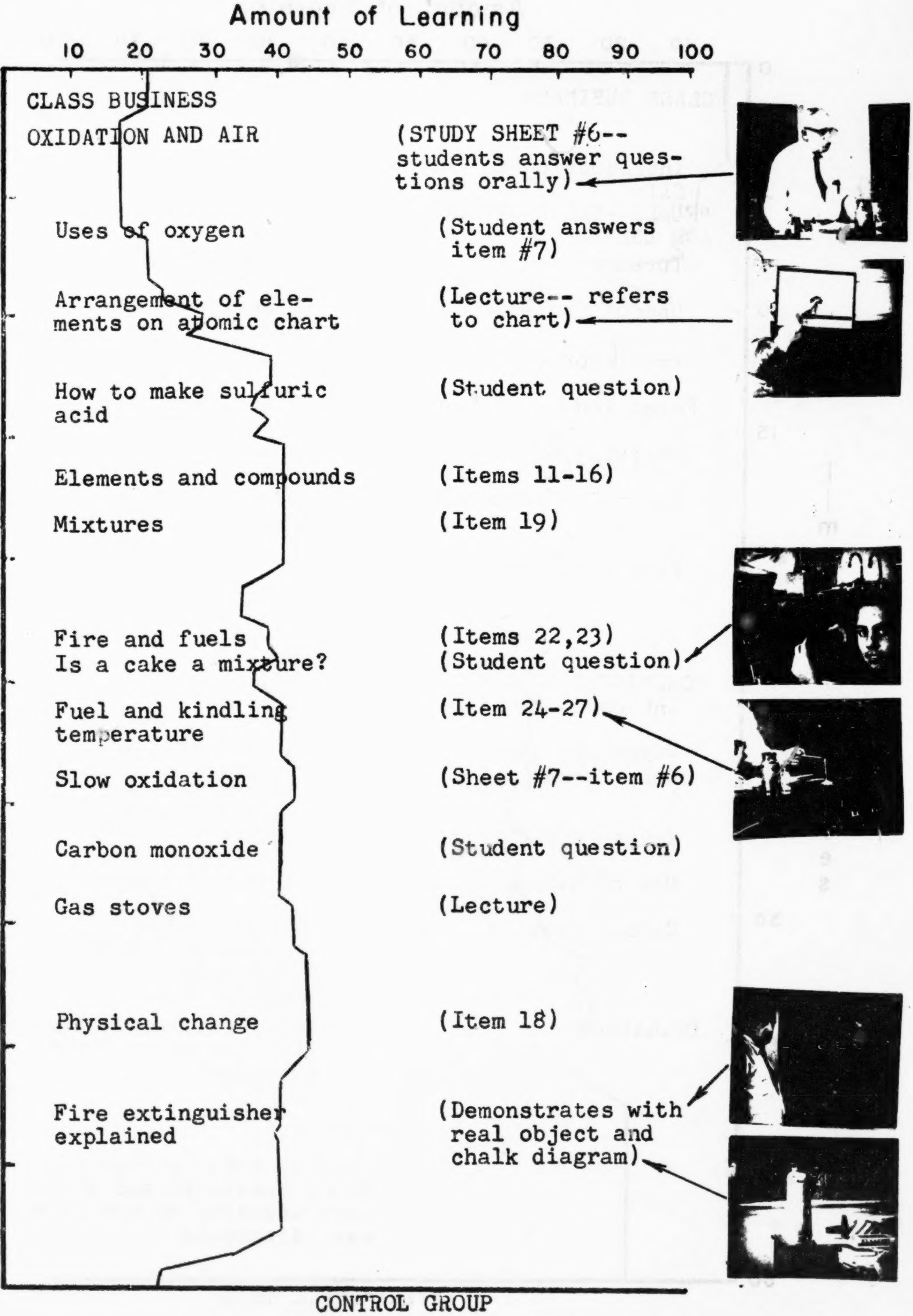
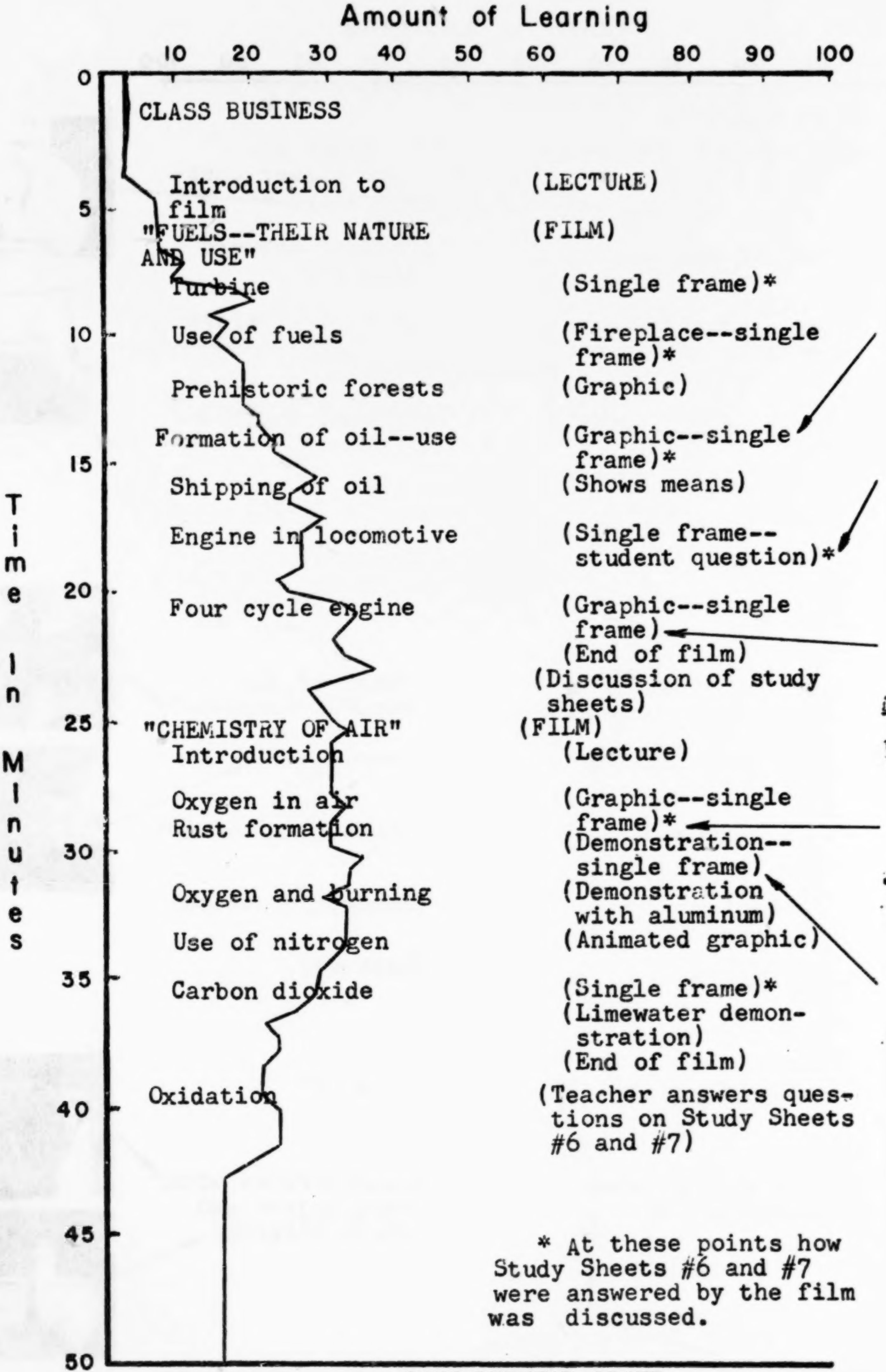
* See also "Analysis of Learning Profiles 65 and 66".



CONTROL GROUP

LEARNING PROFILE NUMBER 71



* At these points how Study Sheets #6 and #7 were answered by the film was discussed.

EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 72

ANALYSIS OF LEARNING PROFILES 71 AND 72

Two of the study sheets to guide textbook study were answered by lecture-discussion in the Control Group (C71) and by two films* in the Experimental Group.

Reasons for the generally lower level of learning in the Experimental Group are (1) the Control Group was receiving direct answers to the study sheet which guided their textbook study, (2) application of the information presented in the films to answering or checking the study sheet questions was difficult for the students in the Experimental Group; and (3) the showing of two films in one period was difficult for the Experimental Group, particularly with the time needed for discussion cut short.

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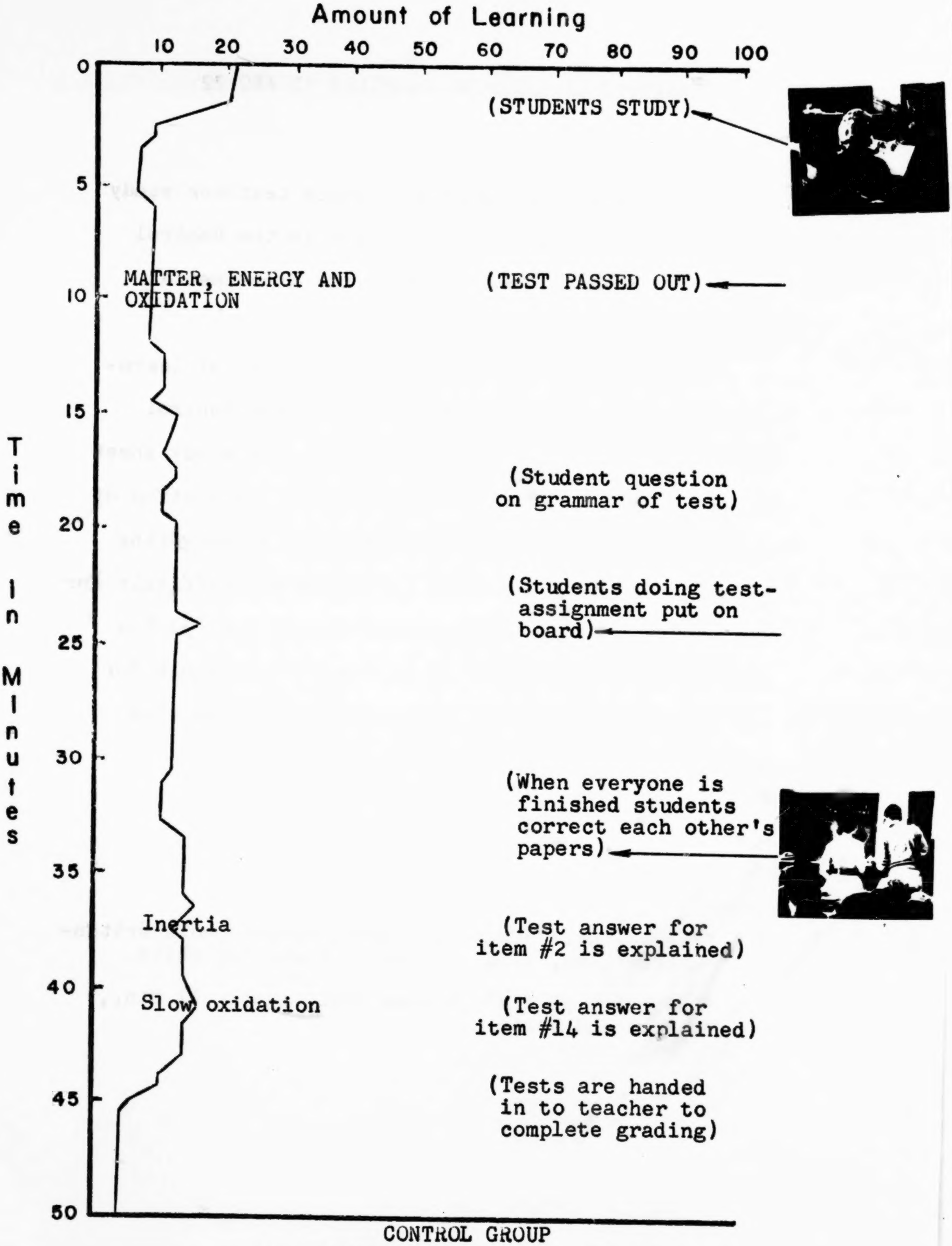
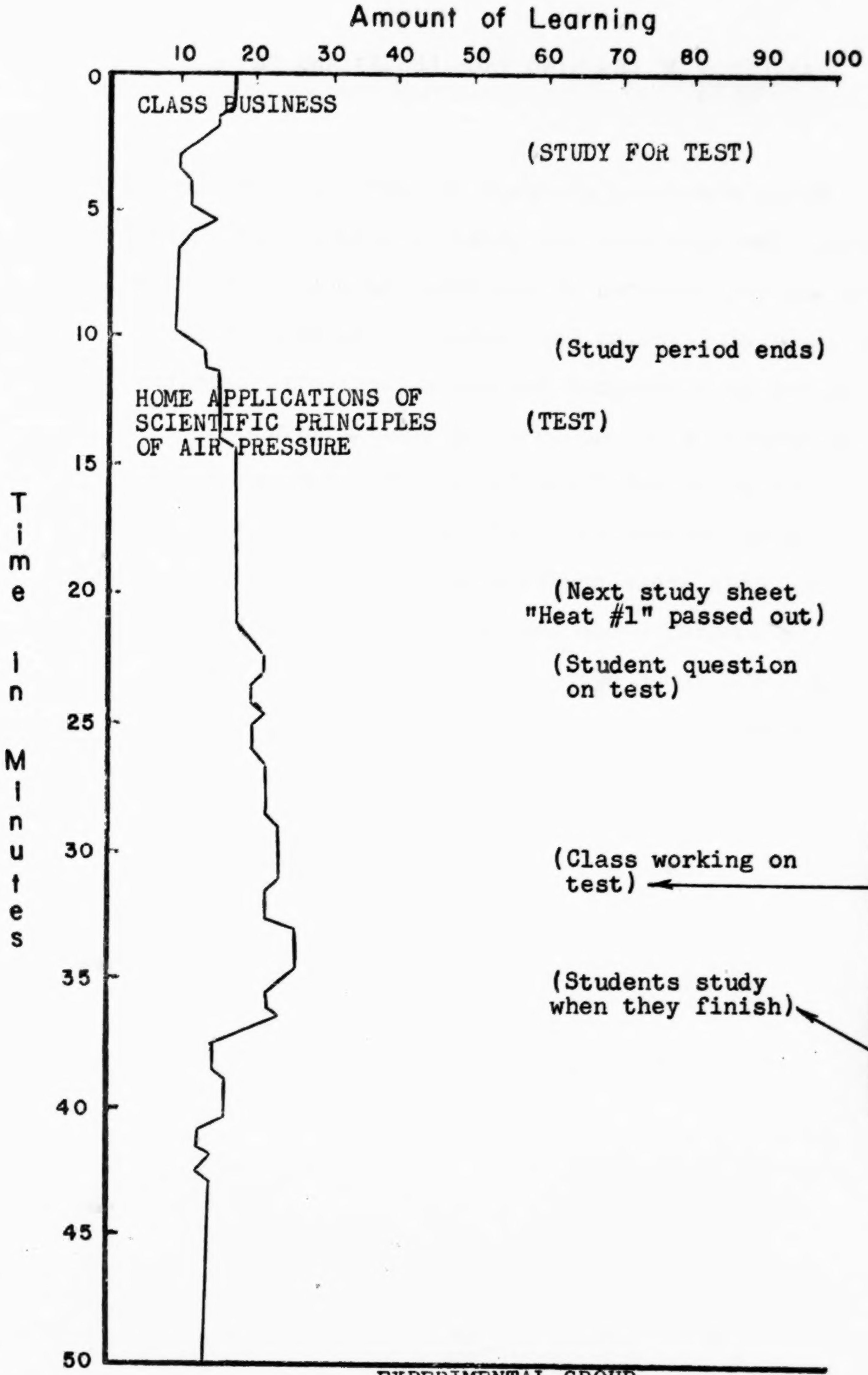
* "Fuels--Their Nature and Use", Encyclopedia Britannica Films, 1958. 11 min., black and white.

"Chemistry of Air", McGraw Hill, 1955. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 73



CLASS BUSINESS

(STUDY FOR TEST)

(Study period ends)

HOME APPLICATIONS OF
SCIENTIFIC PRINCIPLES
OF AIR PRESSURE

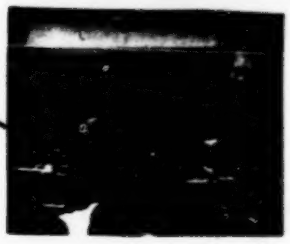
(TEST)

(Next study sheet
"Heat #1" passed out)

(Student question
on test)

(Class working on
test)

(Students study
when they finish)



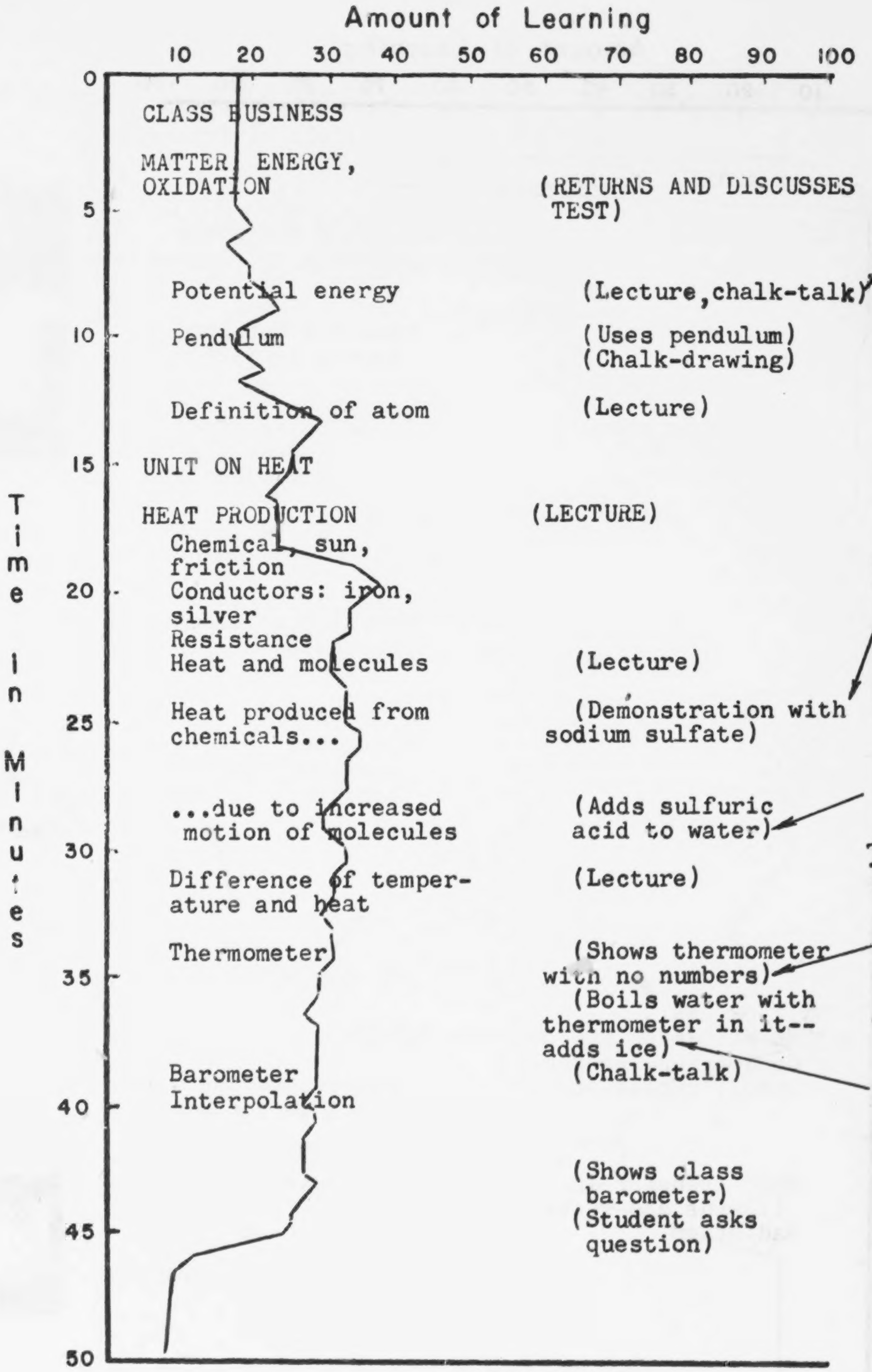
EXPERIMENTAL GROUP

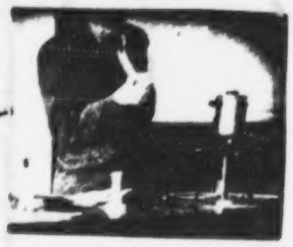
LEARNING PROFILE NUMBER 74

ANALYSIS OF LEARNING PROFILES 73 AND 74

There were no high peaks of learning in either group. The same test was given to both groups; this test was not prepared by the State Education Department. The level of learning was higher in the Experimental Group but this resulted becuase prior to the test the Experimental Group had been the Control Group.

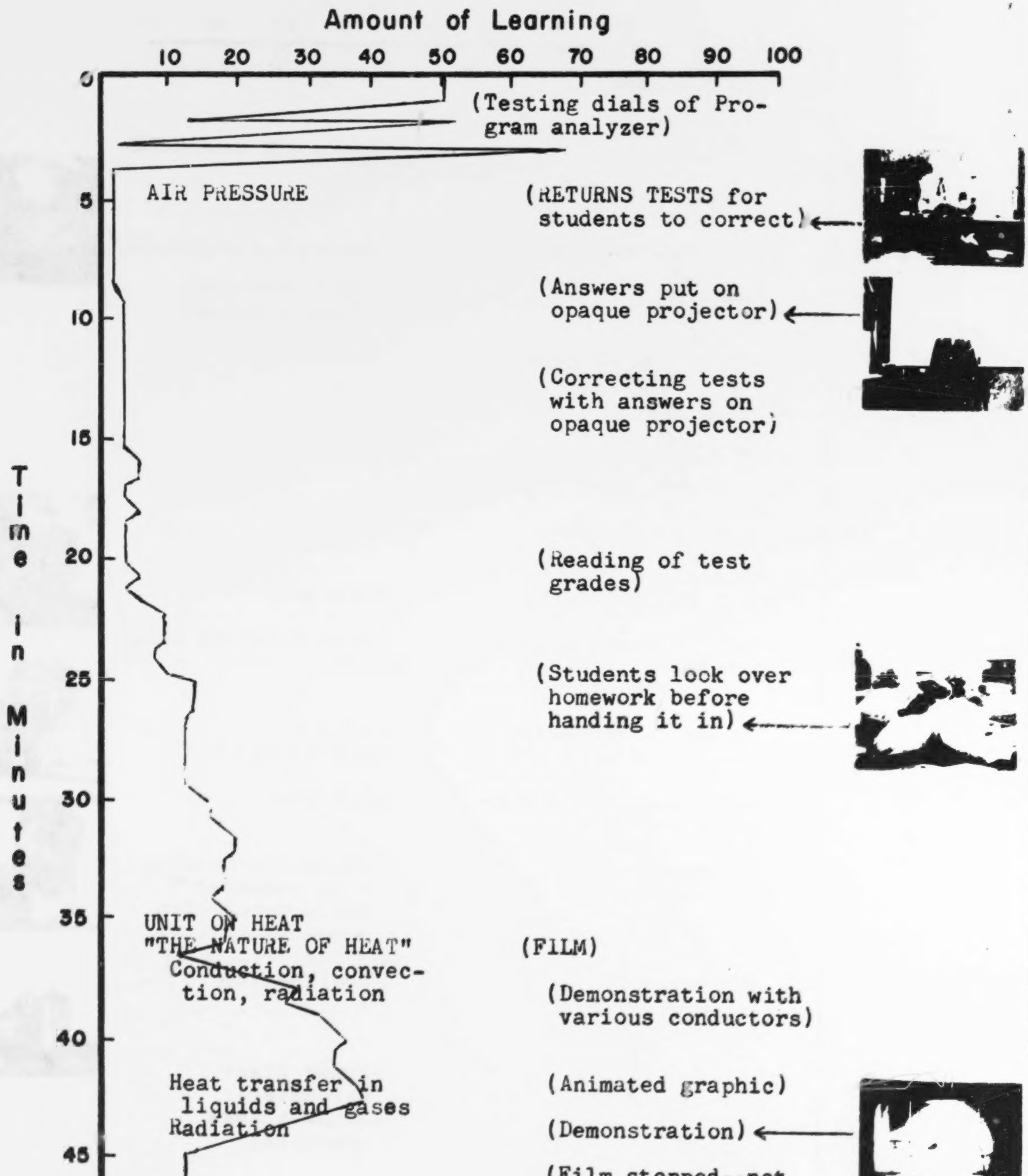
As the Control Group the Experimental Group had not covered certain areas of the test by means of communications media and a previous pattern had been established that the Control Group learned more during a test because it had not covered certain areas by means of communications media.





CONTROL GROUP

LEARNING PROFILE NUMBER 75



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 76

ANALYSIS OF LEARNING PROFILES 75 AND 76

Students learned less in the Experimental Group because they were grading a test (E76, 5-21) rather than discussing the test as had been done in the Control Group (C73, 33-44) and (C75, 4-14).

The students in both of the groups did not do well on the test. The 21 minutes of going over the test in the Control Group may have given it an advantage in the formal test given on air, oxidation and heat (C93). The 9 minutes devoted to checking each others' papers in the Experimental Group (E76, 7-16) did not allow time for study or notes. The opaque projector was used to show the test answers and to make possible this rapid means of grading.

Greater learning resulted from use of a film* to introduce the next unit on heat in the Experimental Group (E76, 36-44) than in the Control Group with lecture and demonstration (C75, 15-45). Again the Control Group was favored, however, by 30 minutes of instruction on heat as compared to 8 minutes in the Experimental Group devoted to grading and 8 minutes of class discussion on a later day (E78, 8-16).

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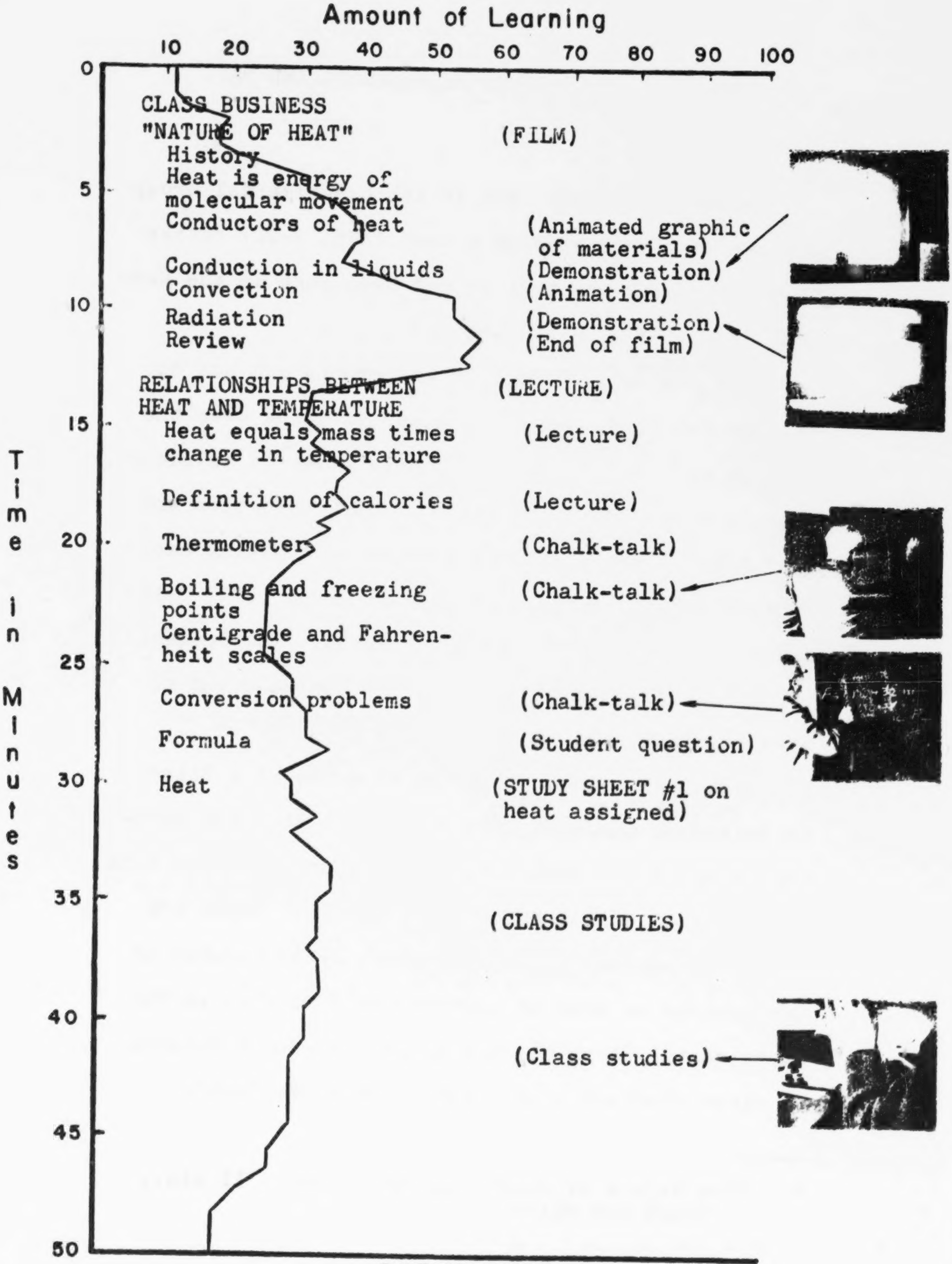
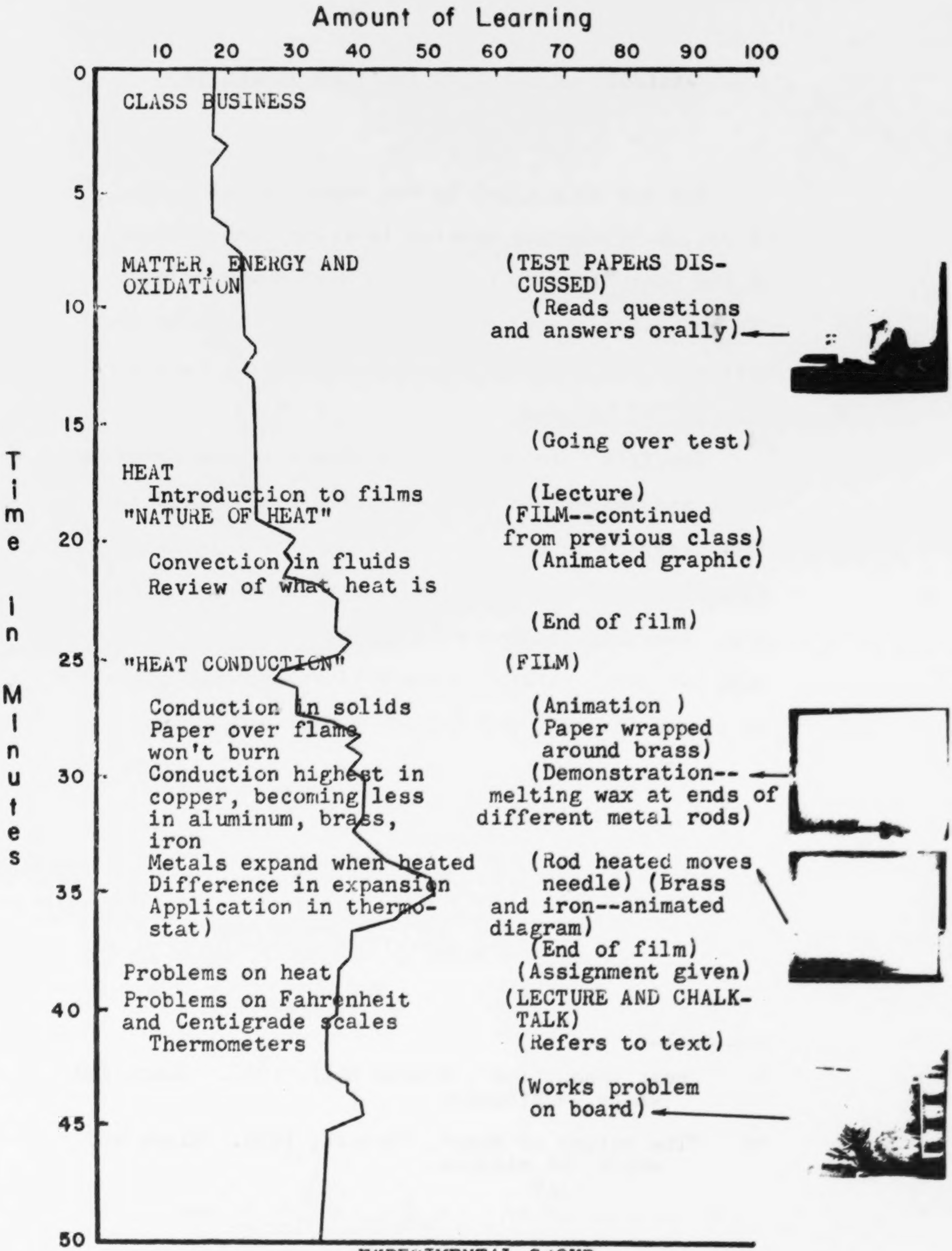
* "The Nature of Heat", Coronet, 1958. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 77



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 78

ANALYSIS OF LEARNING PROFILES 77 AND 78

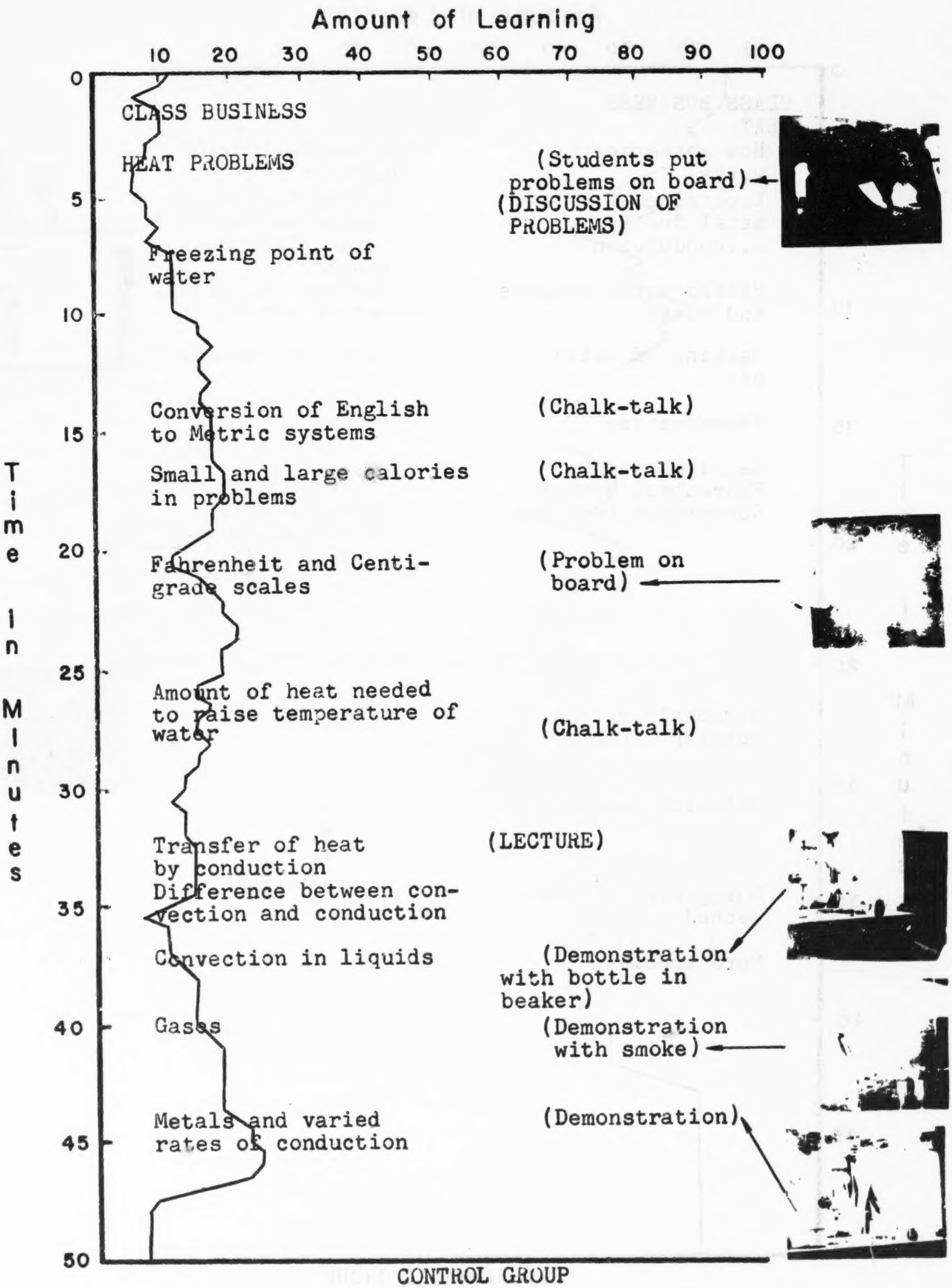
The use of a film* in the Experimental Group (E 76, 26-38) led to greater learning than lecture in the Control Group (C 77, 14-25). However, only the general subject of the film was the same as the lecture. The specific content of the film varied from that of the lecture.

The film** shown in its entirety to the Control Group and in part to the Experimental Group led to less learning in the latter because the film had been shown in two parts, the first part on the previous day. Learning increased in the Experimental Group when overhead transparencies related to the film were used the next day (cited in next analysis).

---

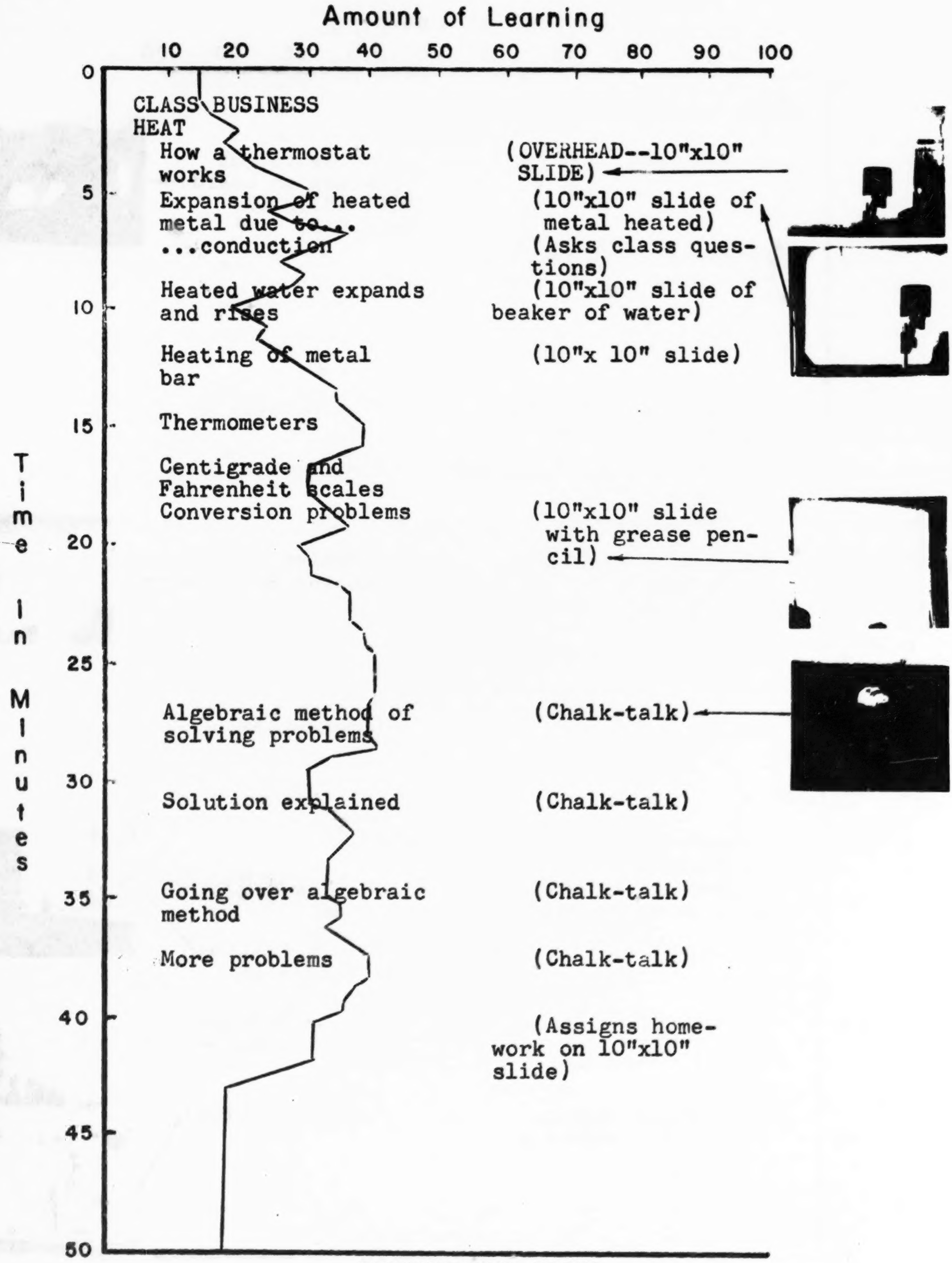
* "Heat Conduction", McGraw Hill, 1955. Black and white, 9 minutes.

** "The Nature of Heat", Coronet, 1958. Black and white, 11 minutes.



CONTROL GROUP

LEARNING PROFILE NUMBER 79



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 80

ANALYSIS OF LEARNING PROFILES 79 AND 80

Use of transparencies* to review key points of a film shown in parts on two previous class days led to relatively higher learning (E80, 3-13).

The Experimental Group learned more about conversion problems (E80, 17-27) by means of an overhead transparency** than did the Control Group by means of chalk-talk (C79, 14-25).

---

* "Heat Conduction", Transparency IV. F., G., H., and I., Division of Educational Communications, New York State Education Dept., 1960. 10"x 10" slide, two colors.

** "Problems on Heat", Transparency IV. A., same as above.

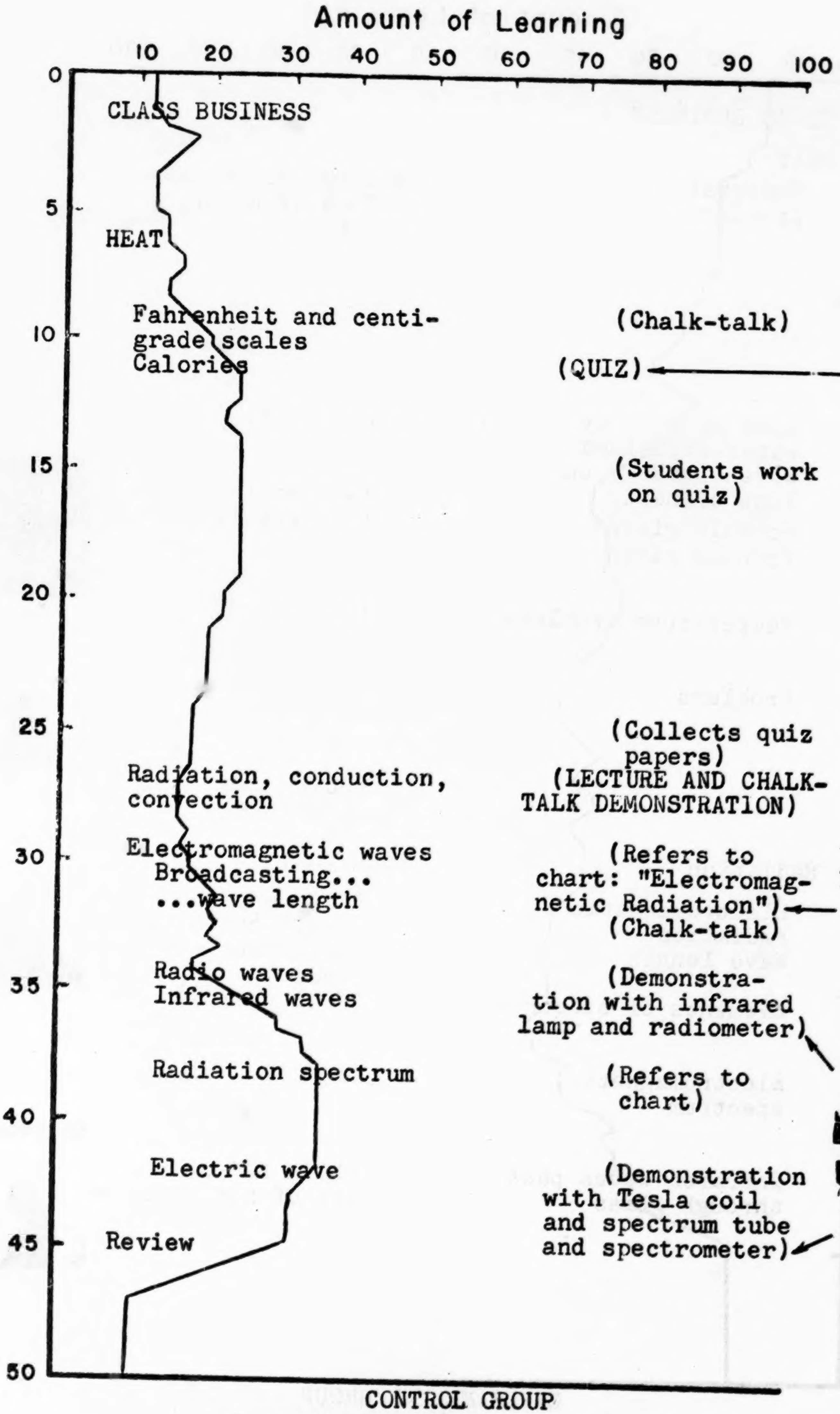
ANALYSIS OF LEARNING PROFILES 81 AND 82

Learning was greater in the Experimental Group than in the Control Group. Lecture, wall chart* and demonstrations concerning electromagnetic waves resulted in less learning in the Control Group (C81, 30-45) than an overhead transparency** used in addition to the wall chart in the Experimental Group (E82, 31-43) to show in simplified form key information shown in detail on the wall chart. The same wall chart was used in both groups.

---

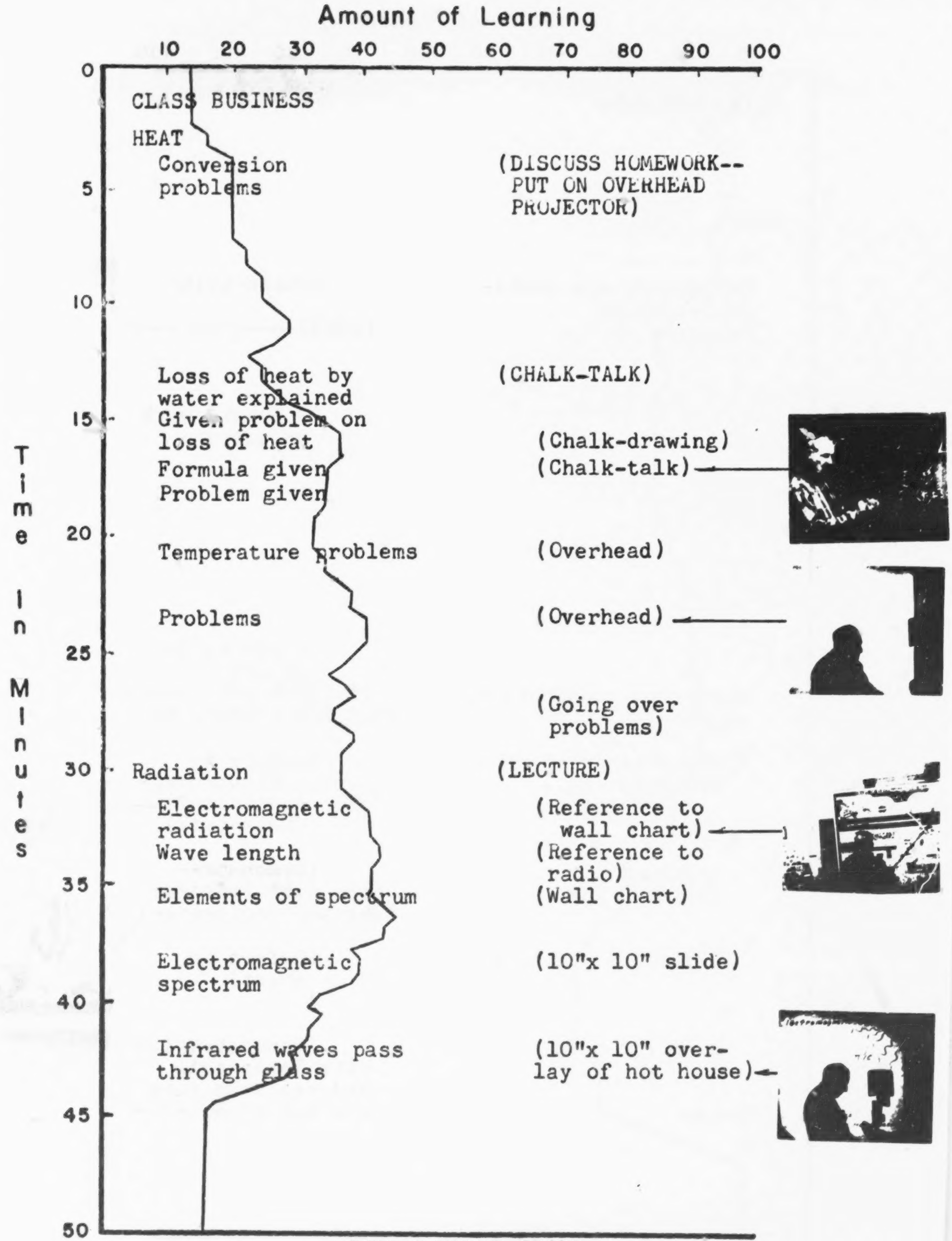
* Arthur Comptom, "Chart of Electromagnetic Radiation", W. M. Welch Co., 1944. 58" x 41", color.

** "Electromagnetic Radiation", Transparency IV C-1-10, Technifax Corporation, n.d. 7-5/8" x 10", color.



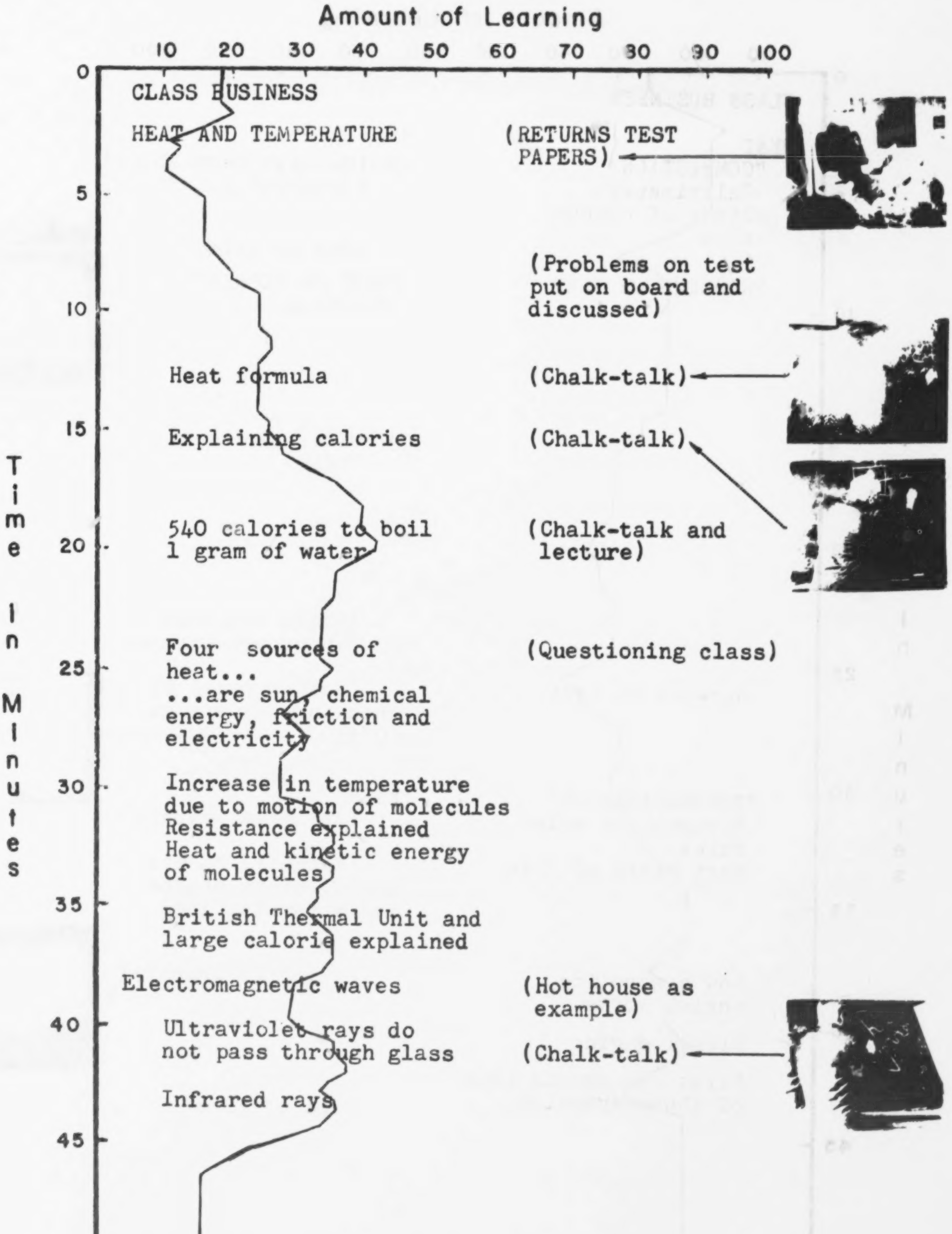
CONTROL GROUP

LEARNING PROFILE NUMBER 81



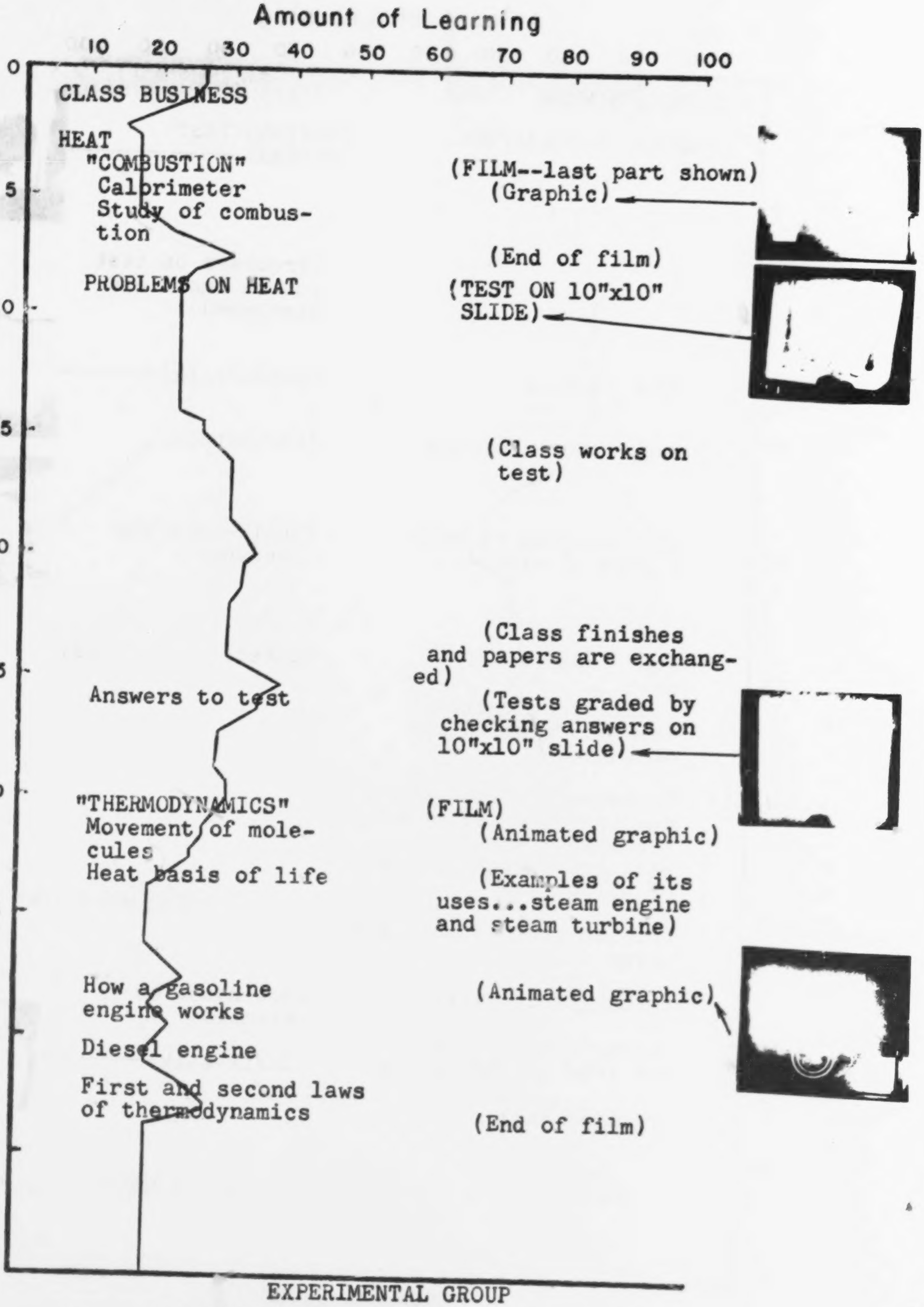
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 82



CONTROL GROUP

LEARNING PROFILE NUMBER 83



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 84

ANALYSIS OF LEARNING PROFILES 83 AND 84

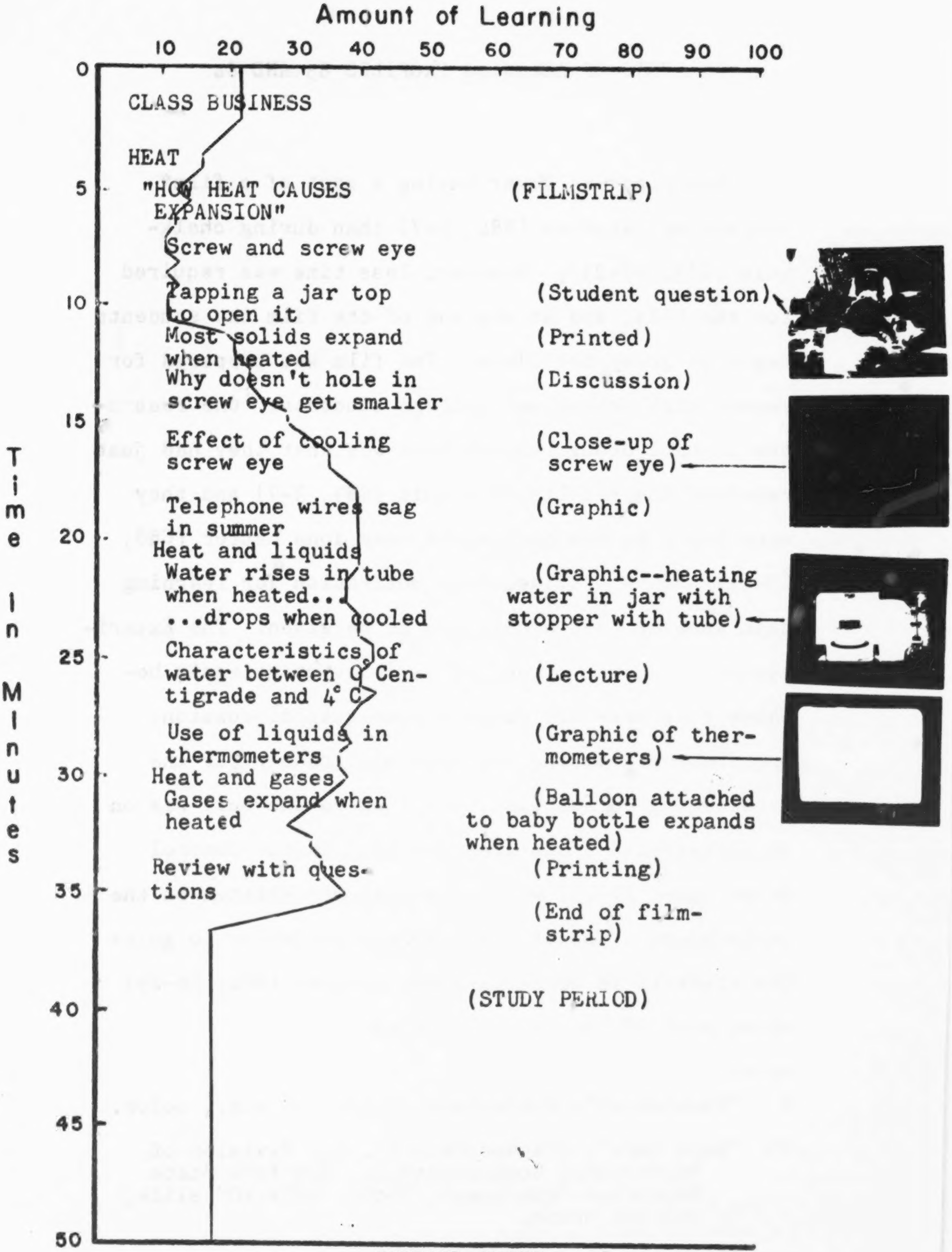
Learning was lower during a part of a film* concerning calories (E84, 3-7) than during chalk-talk (C83, 15-23). However, less time was required for the film, and at the end of the film the students began to grasp the ideas. The film was prepared for senior high school and college students. One reason the Control Group learned more was that they had just received the results of a quiz (C83, 3-7) and they were learning how they could have done better (C88, 10-21). This provided more motivation for learning than knowing that a quiz was to be given. The Experimental Group was placed at a disadvantage again because they were not given a post-quiz discussion.

Learning during the quiz was greater for the Experimental Group (E84, 9-23) where the quiz was on an illustrated transparency** than in the Control Group (C81, 12-25) where the quiz was written on the chalk-board. Use of the overhead projector to guide the students in correcting the quizzes (E84, 26-29) saved much of the teacher's time.

---

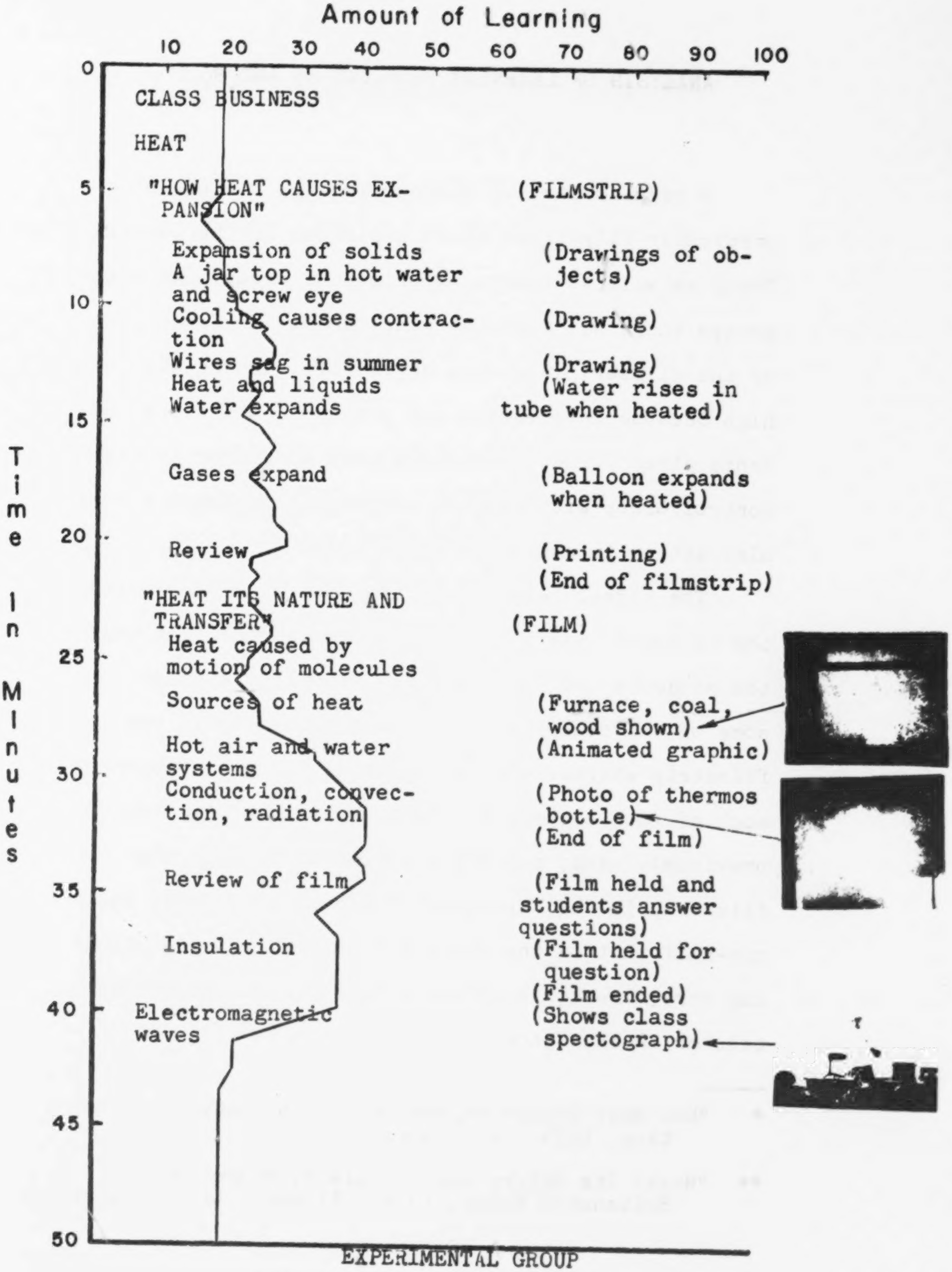
* "Combustion", Sutherland, 1958. 15 min., color.

** "Heat Quiz", Transparency IV. Z., Division of Educational Communications, New York State Education Department, 1960. 10"x 10" slide, red and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 85



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 86

ANALYSIS OF LEARNING PROFILES 85 AND 86

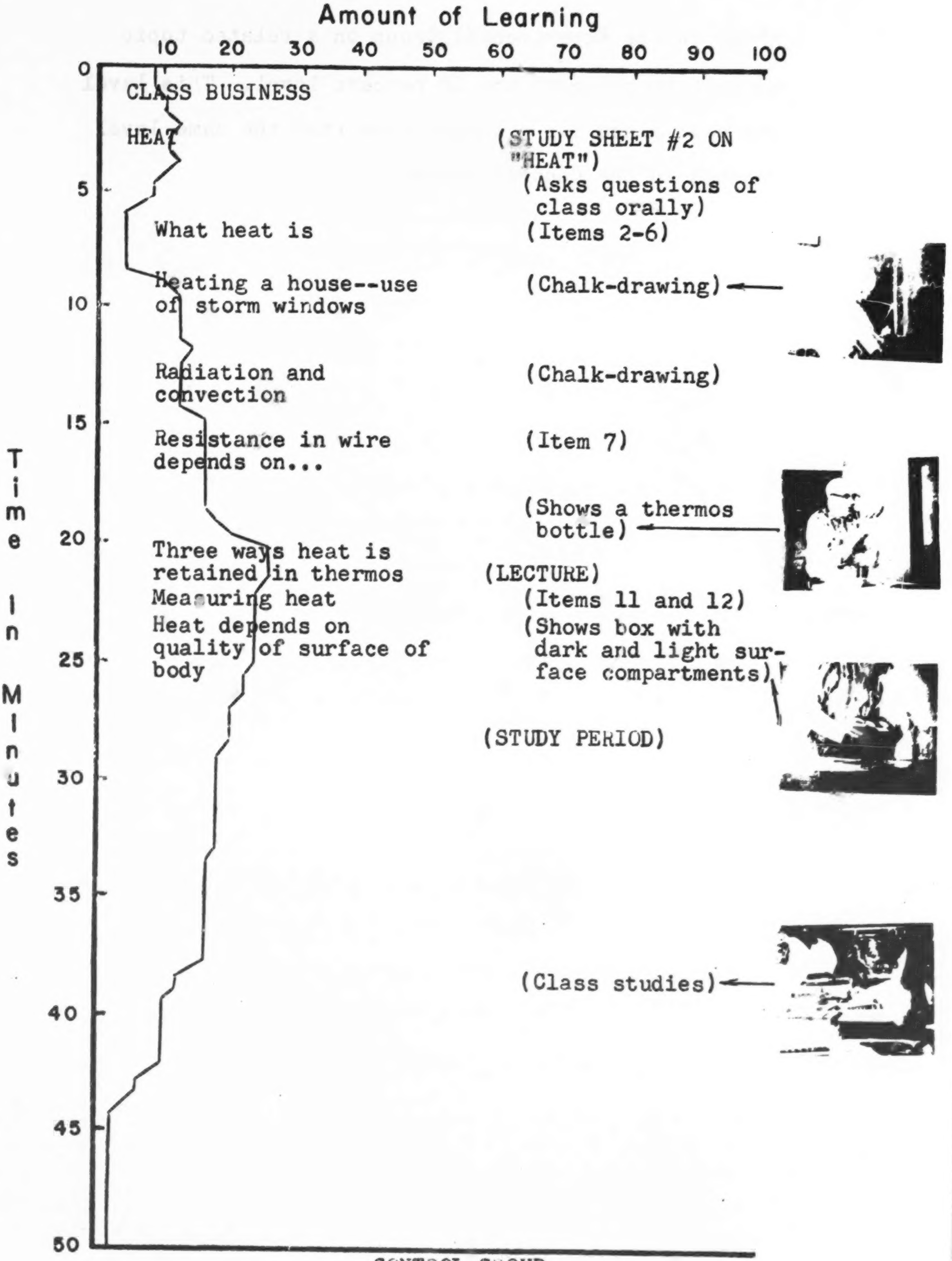
A regular part of instruction was the use of a particular filmstrip* so it was shown in the Control Group as well as in the Experimental Group. In both groups there was some learning during the first part of the filmstrip, but the degree of learning was not high because information was presented which the students already knew. Learning went up higher in the Control Group with graphic drawings illustrating molecular action in expansion (C85, 16).

The higher learning by the Control Group during the filmstrip may have been due to (1) the fact that the students had been learning very little about some of the concepts expressed graphically in the filmstrip whereas the Experimental Group had learned much of such content by other communications media previously used; and (2) the time devoted to the filmstrip in the Experimental Group (E86, 5-20) was one-half that of the Control Group (C85, 5-36) allowing more time for supplementary explanations by the teacher in the Control Group. However, a film** shown in the Experimental Group on a related topic brought learning to the 40 percent level. This level was maintained for a longer time than the same level reached in the Control Group.

---

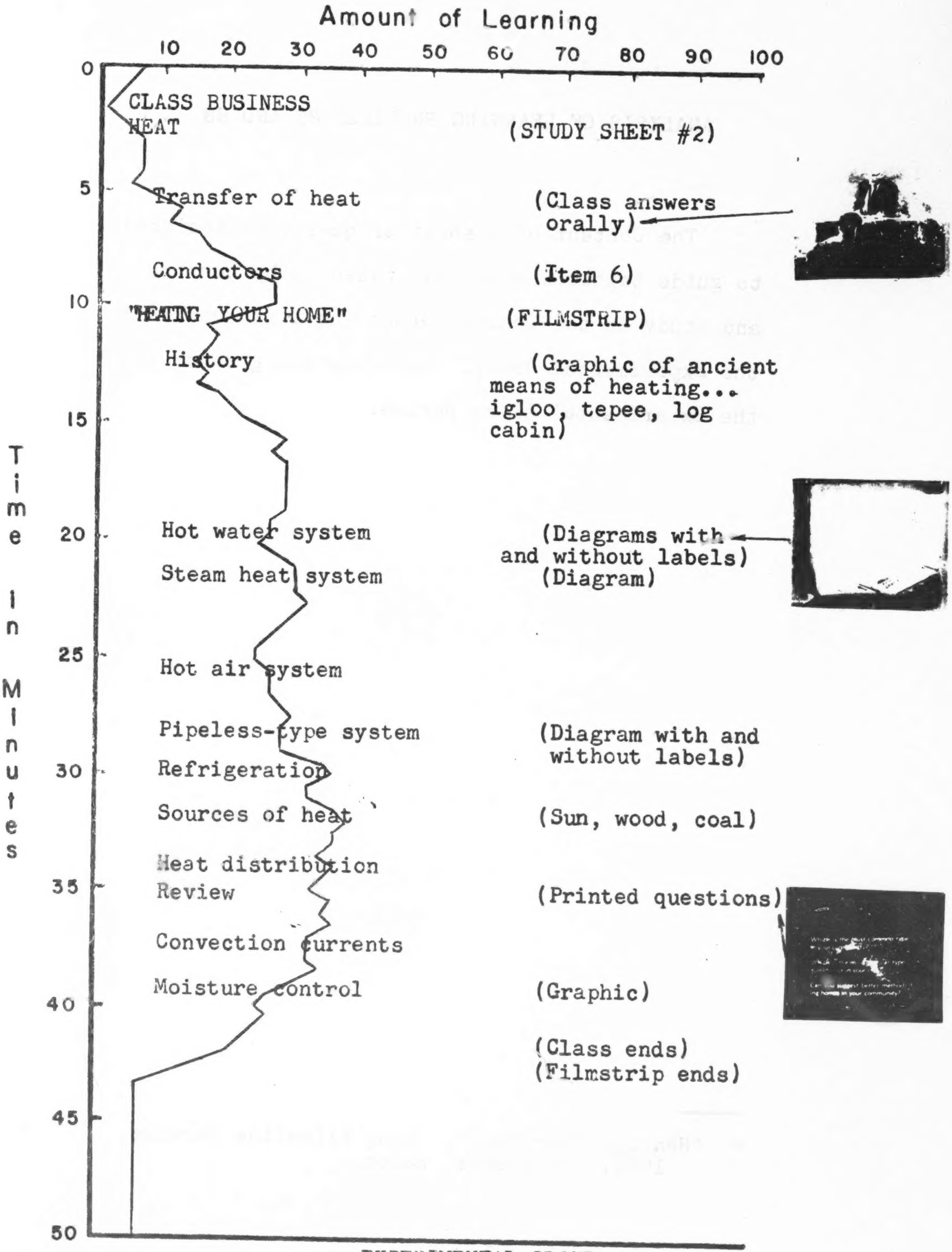
* "How Heat Causes Expansion", Jam Handy Organization, 1959. 37 frames, color.

** "Heat: Its Nature and Transfer", Encyclopedia Britannica Films, 1958. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 87



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 88

ANALYSIS OF LEARNING PROFILES 87 AND 88

The Content of a sheet of questions designed to guide textbook study was taken up by lecture and study in the Control Group and a filmstrip* in the Experimental Group. Learning was greater in the Experimental class period.

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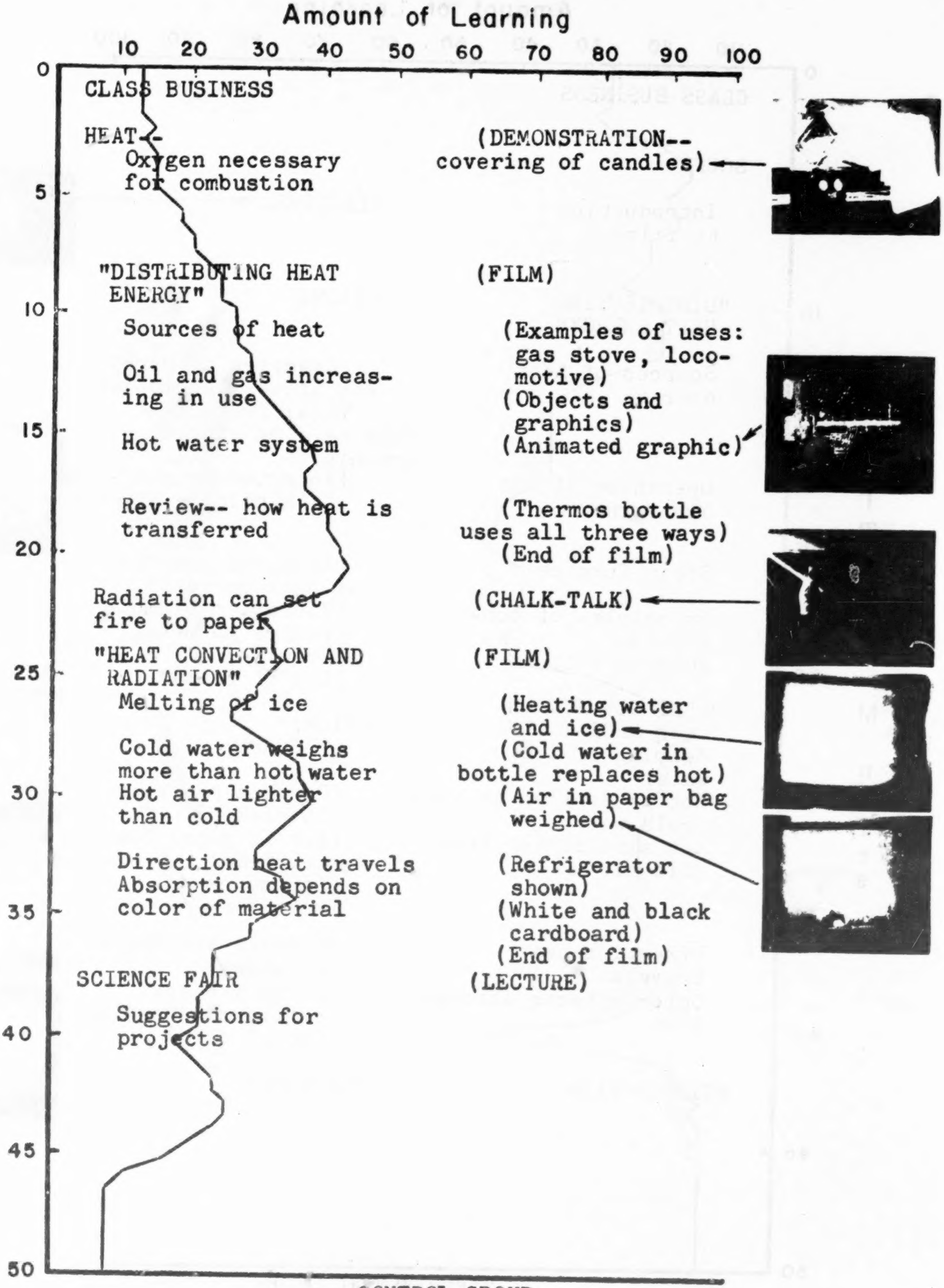
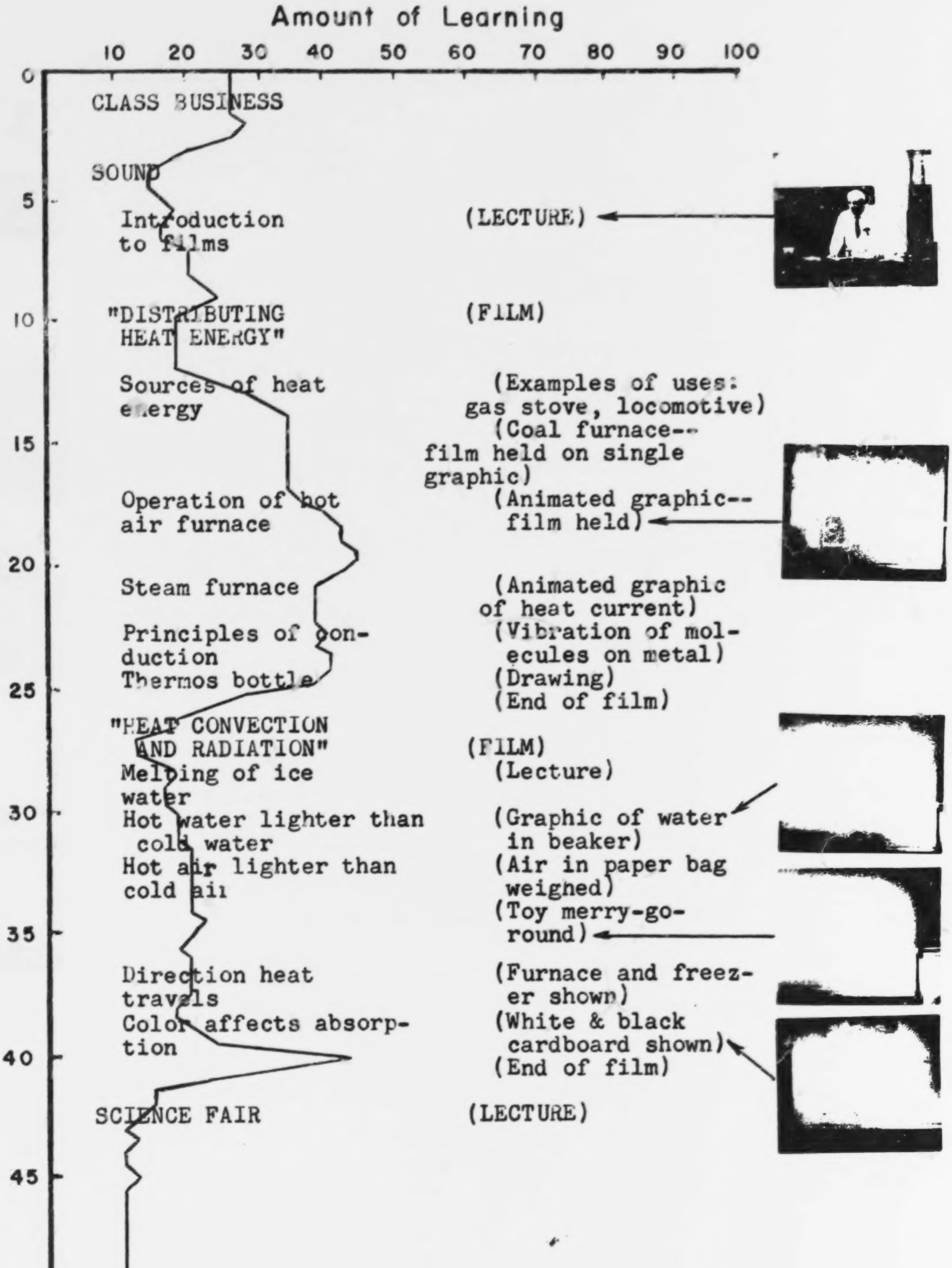
* "Heating Your Home", Long Filmslide Service, 1951. 43 frames, color.



CONTROL GROUP

LEARNING PROFILE NUMBER 89



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 90

ANALYSIS OF LEARNING PROFILES 89 AND 90

The average amount of learning did not vary enough in the two groups to make a significant difference because the same films were shown to both groups. Learning reached a higher level earlier in the Experimental Group (E90, 13-17 as compared to C89, 10-13) in the first film* because the film was stopped showing a graphic drawing which was a key to understanding that part of the film. This allowed the students time to reflect on the preceding part of the film and to take any notes desired.

During the second film** there were no single frames shown and learning was relatively low, although at the end of the film learning increased. The fact that learning was less in the Experimental Group during the first part of the film than in the Control Group (C89, 24-35 as compared to E90, 27-38) was possibly due to (1) the Experimental Group not being able to keep up as well because they had just seen a film with stops for note-taking; and (2) the fact that the Control Group had not had so many related communications media.

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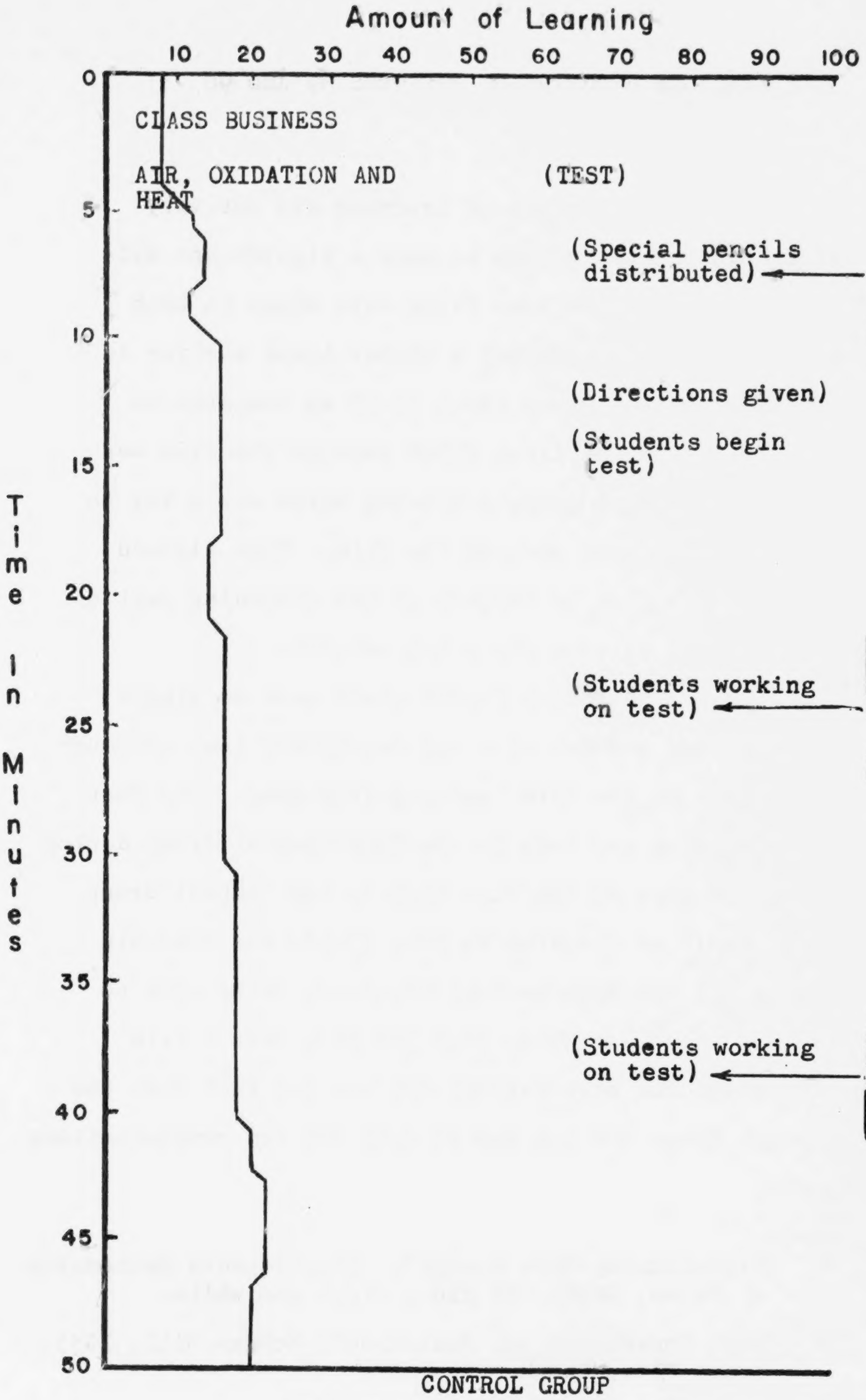
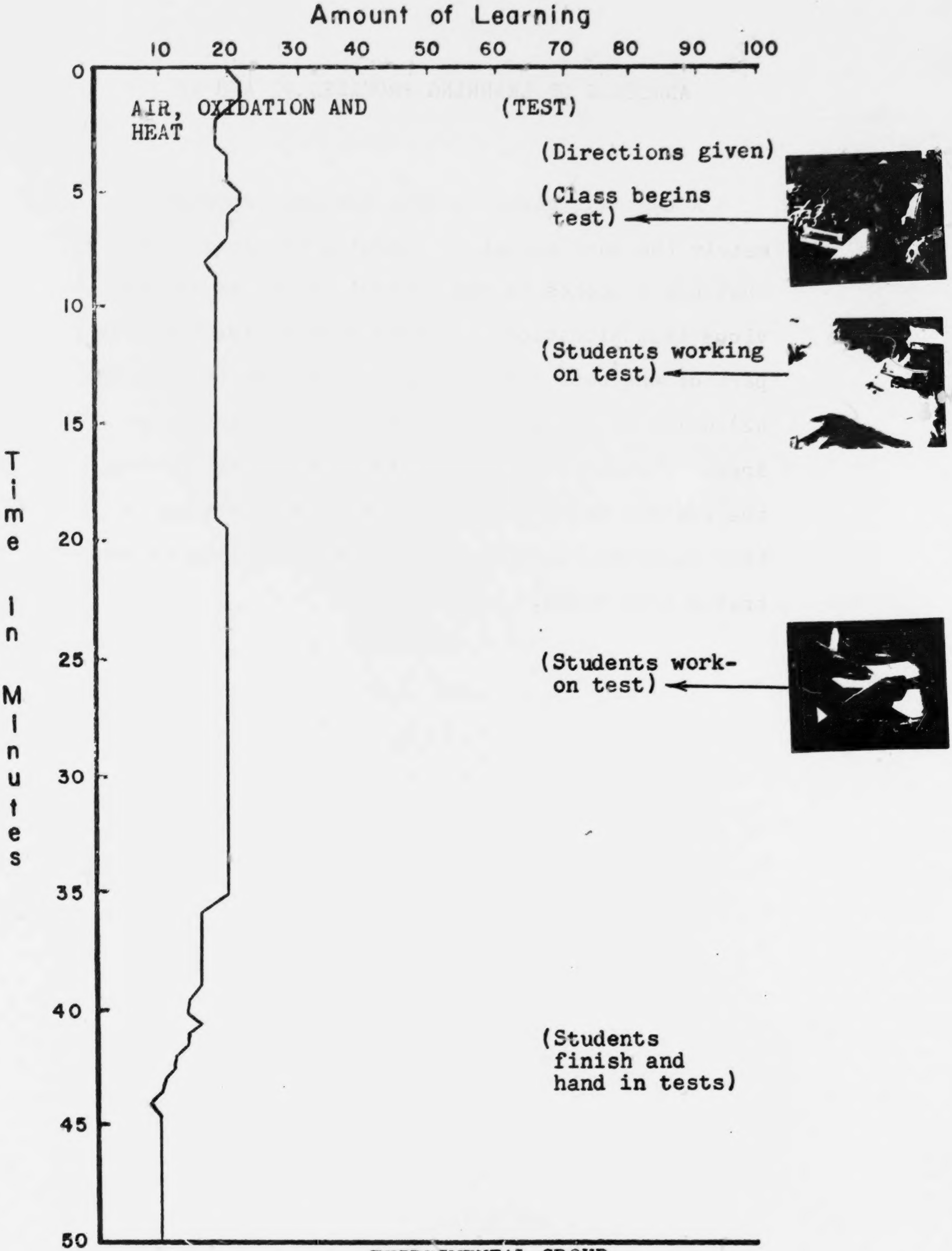
* "Distributing Heat Energy", Encyclopedia Britannica Films, 1938. 11 min., black and white.

** "Heat Convection and Radiation", McGraw Hill, 1955. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 91

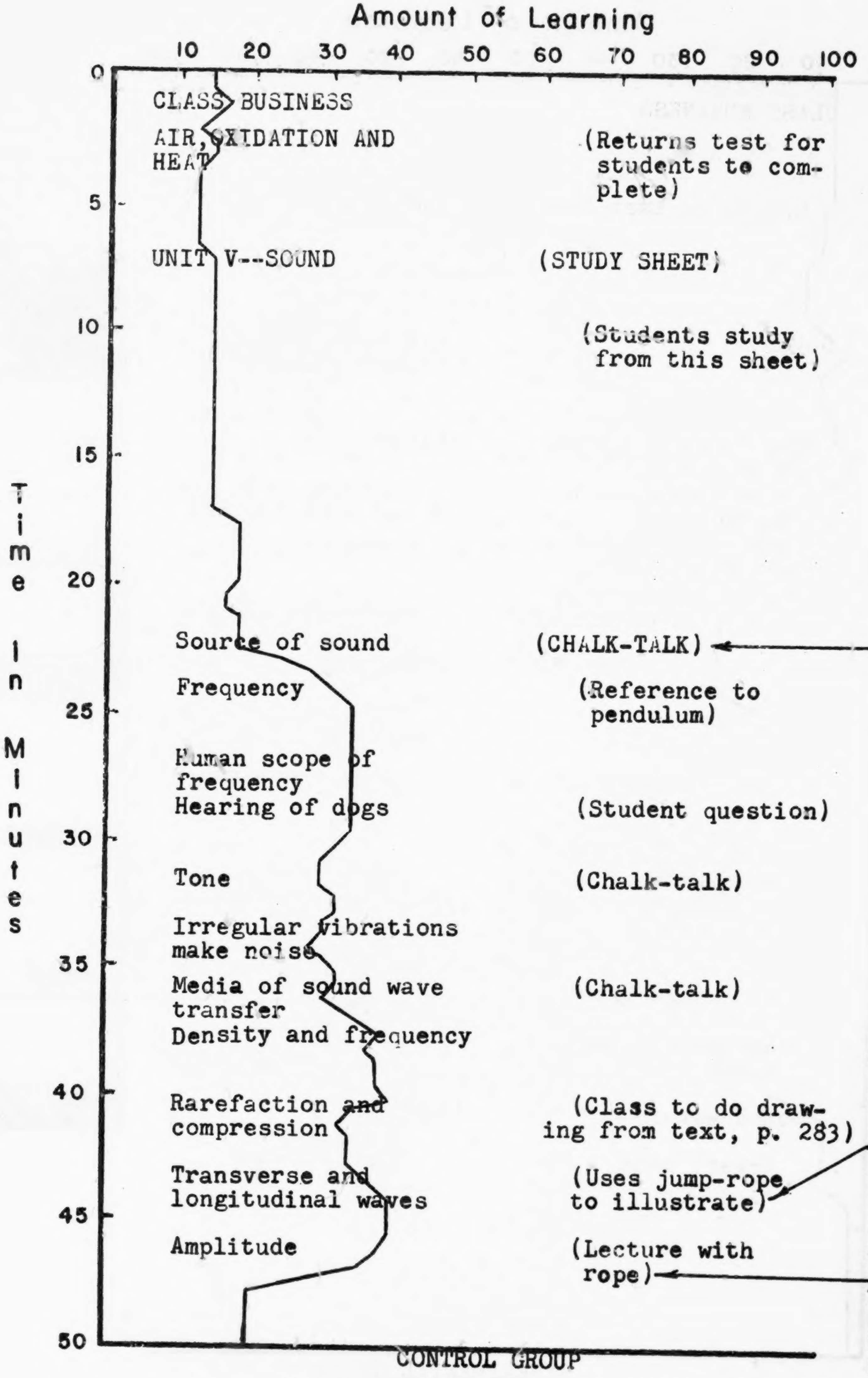


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 92

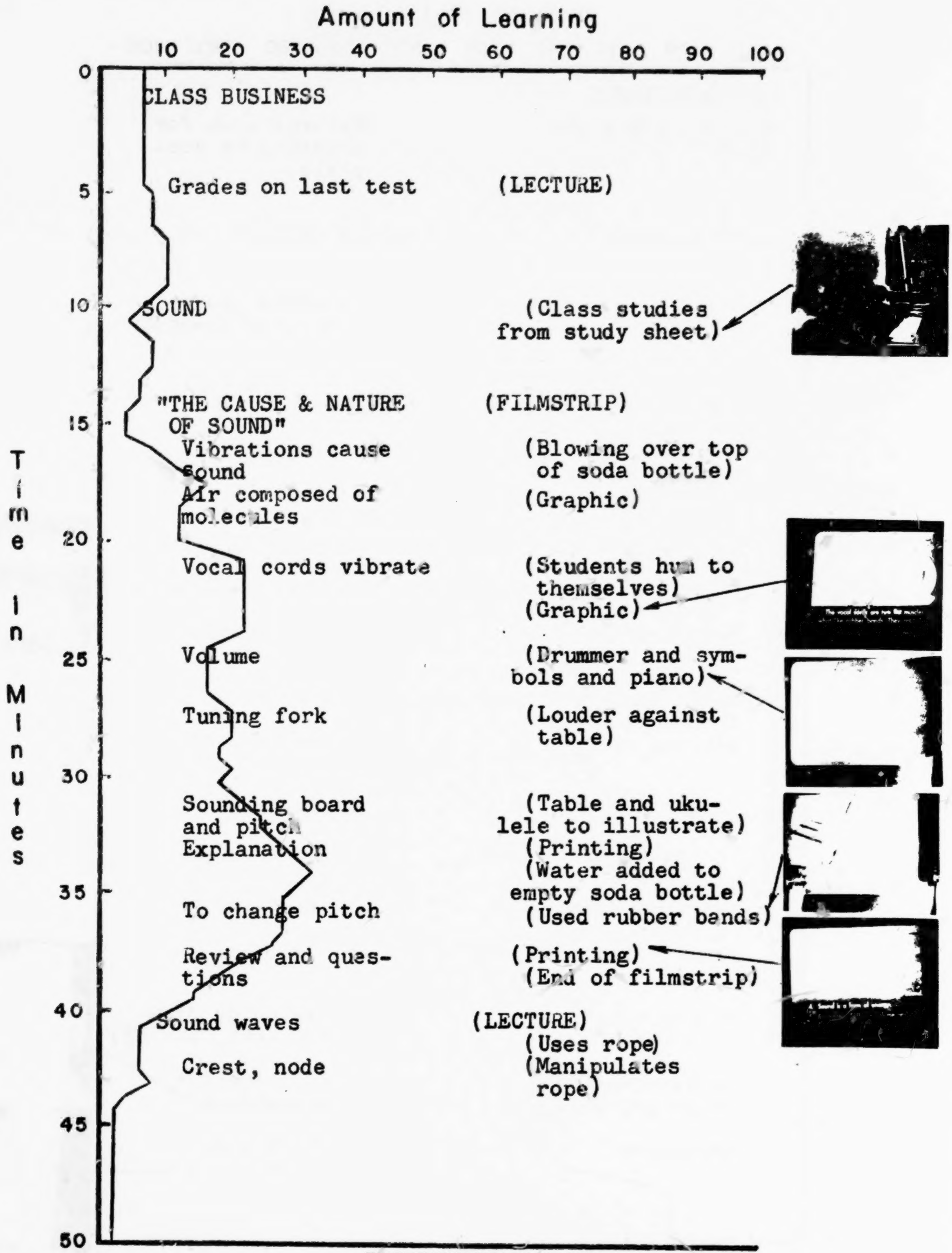
ANALYSIS OF LEARNING PROFILES 91 AND 92

A test was given to both groups. Approximately the same amount of learning resulted except that the students in the Control Group, as in previous test situations, learned more during the last part of the test (C91, 40-47 as compared to E92, 35-42) which was illustrated with diagrams and drawings. This confirmed the pattern established that the Control Group, no matter which was serving in that capacity, learned more during answering illustrated test items.



CONTROL GROUP

LEARNING PROFILE NUMBER 93



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 94

ANALYSIS OF LEARNING PROFILES 93 AND 94

Introduction to a unit was more effective by textbook study guided by a study sheet and chalk-talk in the Control Group than by a filmstrip* in the Experimental Group. Possible reasons for lower learning in the Experimental Group may have been (1) the fact that the class began with the students being reprimanded for poor test grades, and this may have reduced their receptiveness for learning by any means of presentation; (2) the filmstrip covered concepts studied by the students in previous grades; and (3) the spirit of group drive for learning was not in evidence as it was in the Control Group.

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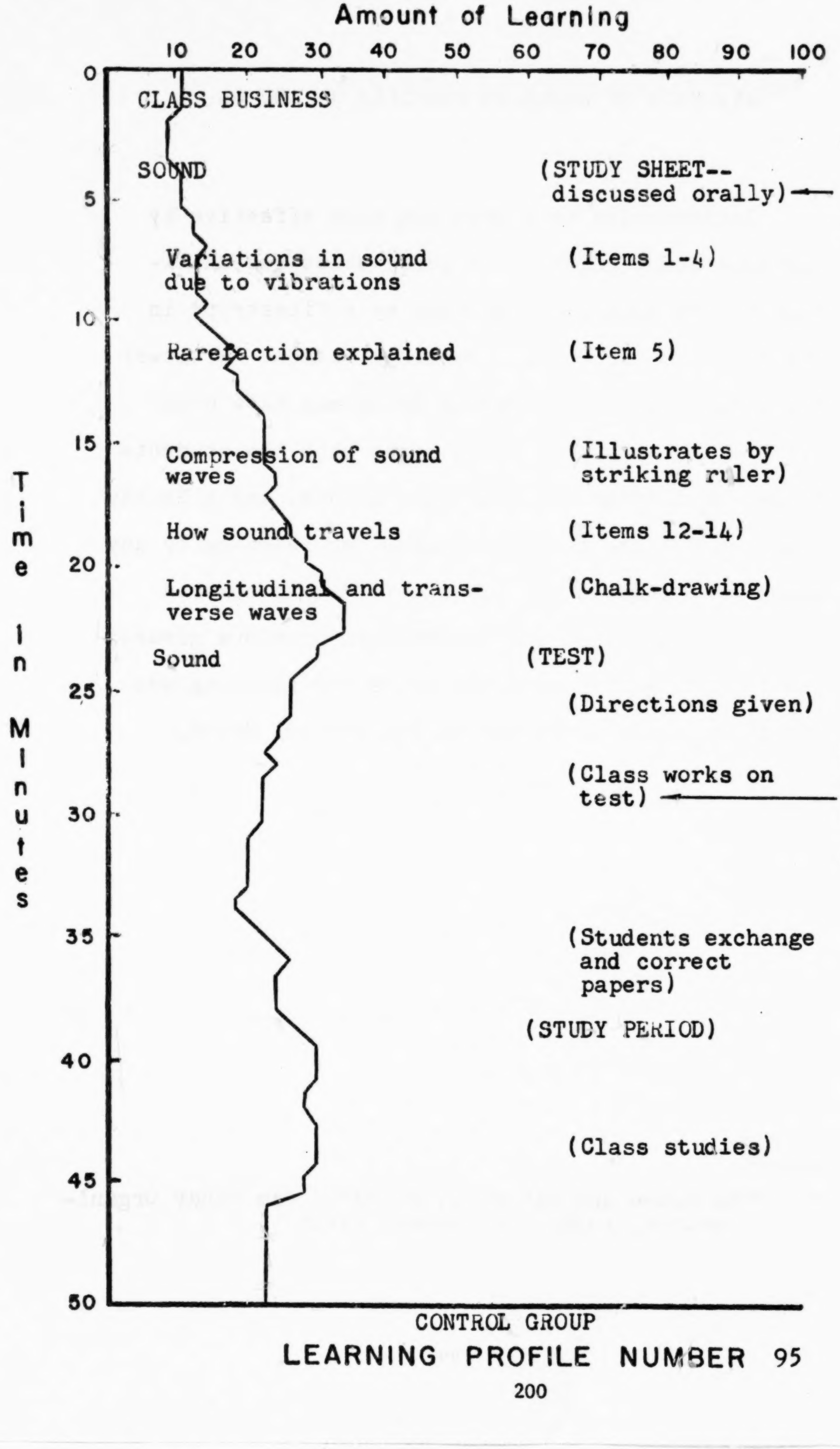
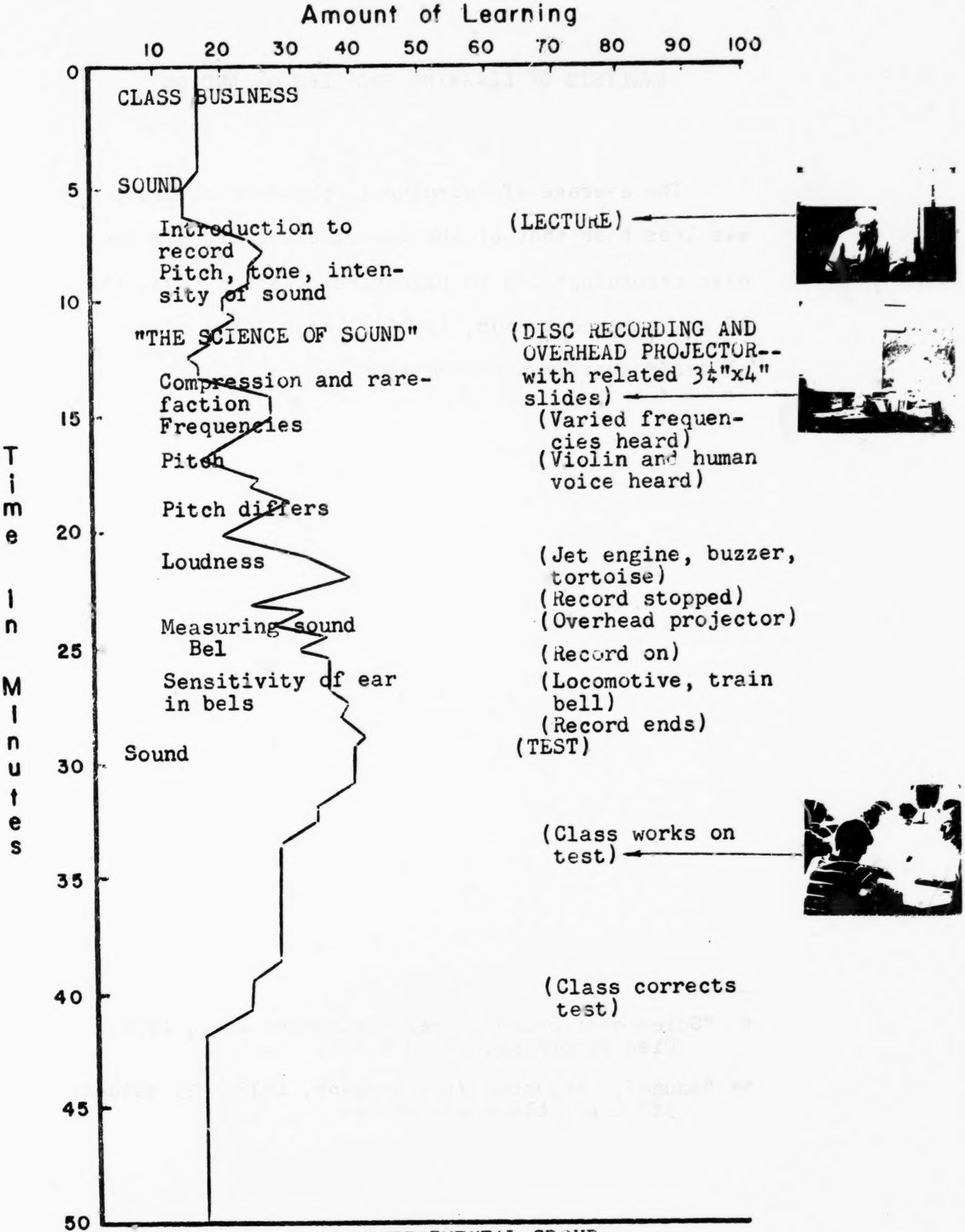
* "The Cause and Nature of Sound", Jam Handy Organization, 1959. 40 frames, color.



CONTROL GROUP

LEARNING PROFILE NUMBER 95



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 96

ANALYSIS OF LEARNING PROFILES 95 AND 96

The average of learning in the Control Group was less than that of the Experimental Group. The disc recording* led to higher compression (C95, 15-17 as compared to E96, 13-15). Four 3¼" x 4" slides** supplemented the disc recording.

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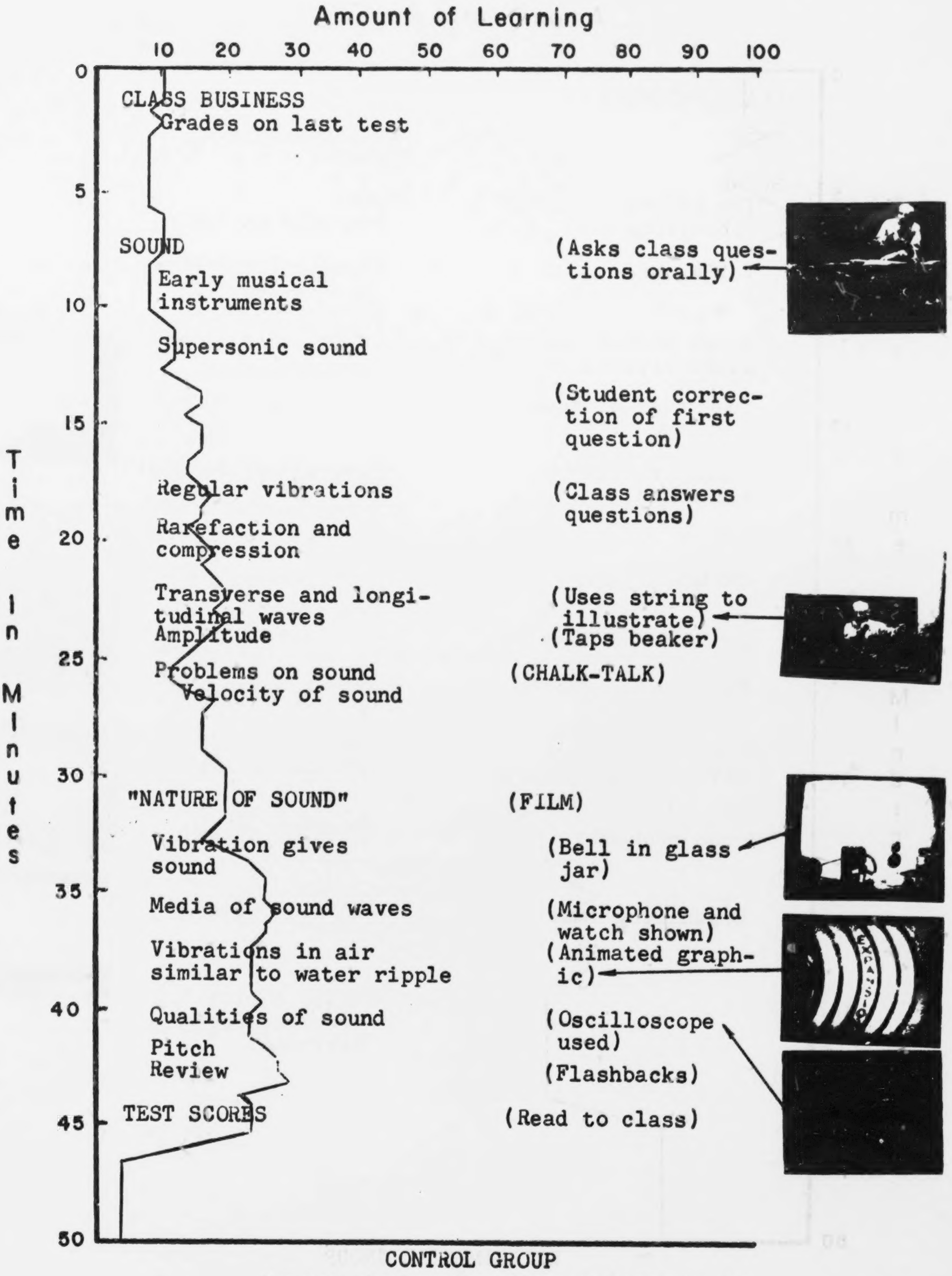
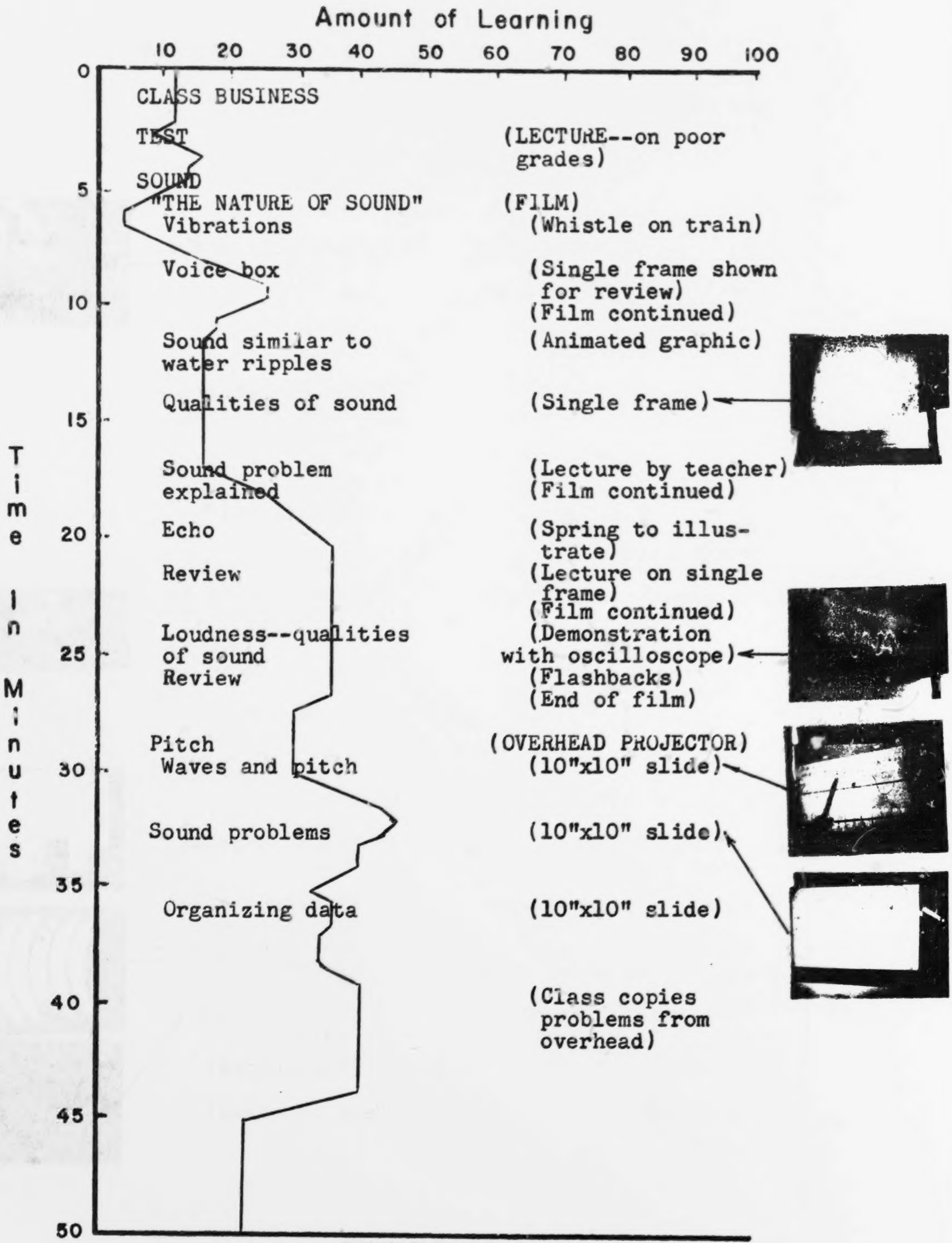
* "Science of Sound", Bell Telephone Inc., 1959. Disc recording, $33^1/3$ r.p.m.

** "Sound", Keystone View Company, 1932. 23 slides, 3¼" x 4", black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 97



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 98

ANALYSIS OF LEARNING PROFILES 97 AND 98

The average of learning in the Experimental Group was almost double that of the Control Group. However, the same film* shown to both groups led to somewhat greater learning in the Control Group (C95, 31-44 as compared to E96, 6-27) because the students had few other communications media by which they could obtain the concepts.

Use of slides** on the overhead projector led to greater learning (E98, 29-44) than chalk-talk and lecture (C97, 7-30).

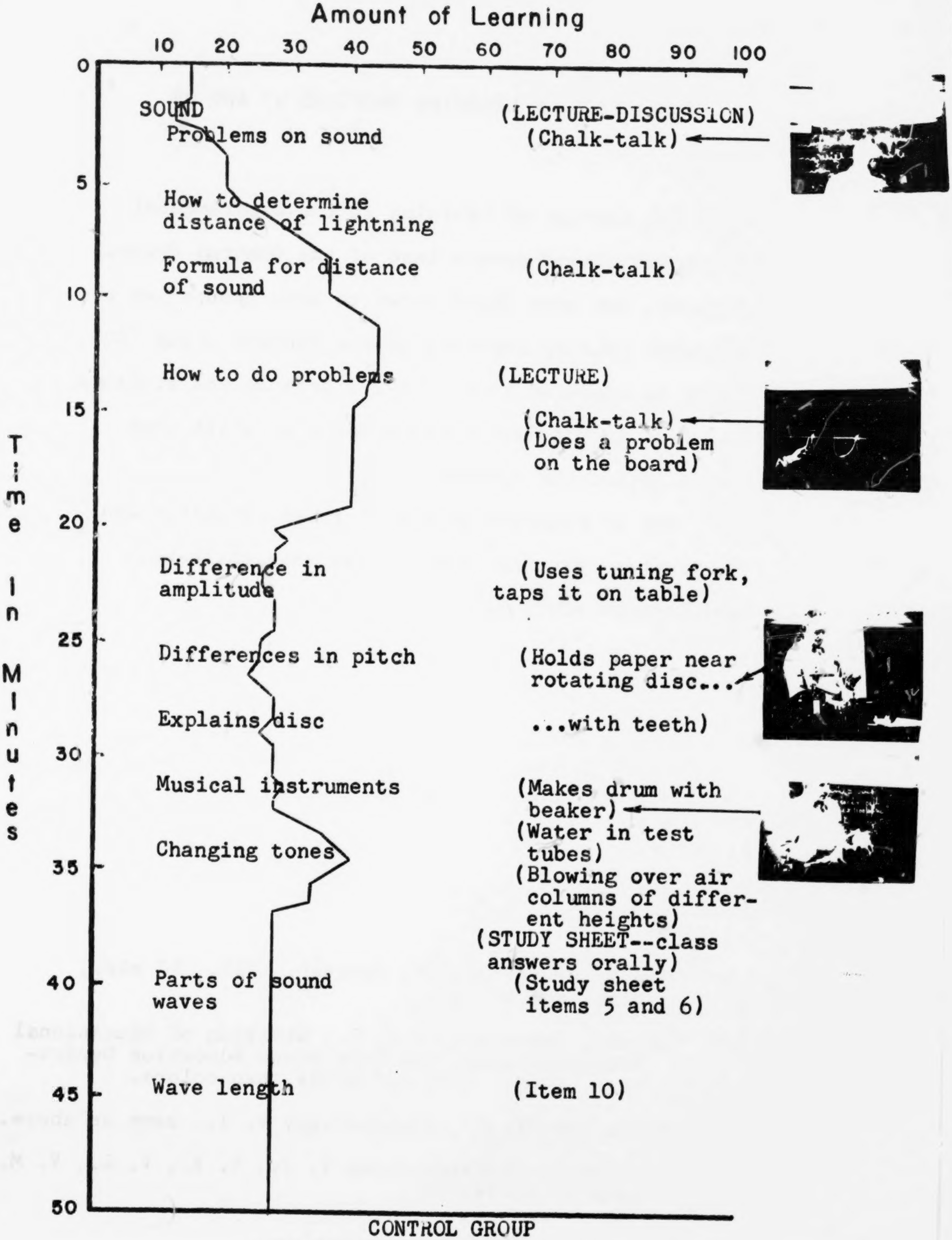
---

* "The Nature of Sound", Coronet, 1947. 10 min., black and white.

** "Pitch", Transparency V. F., Division of Educational Communications, New York State Education Department, 1960. 10"X 10" slide, two colors.

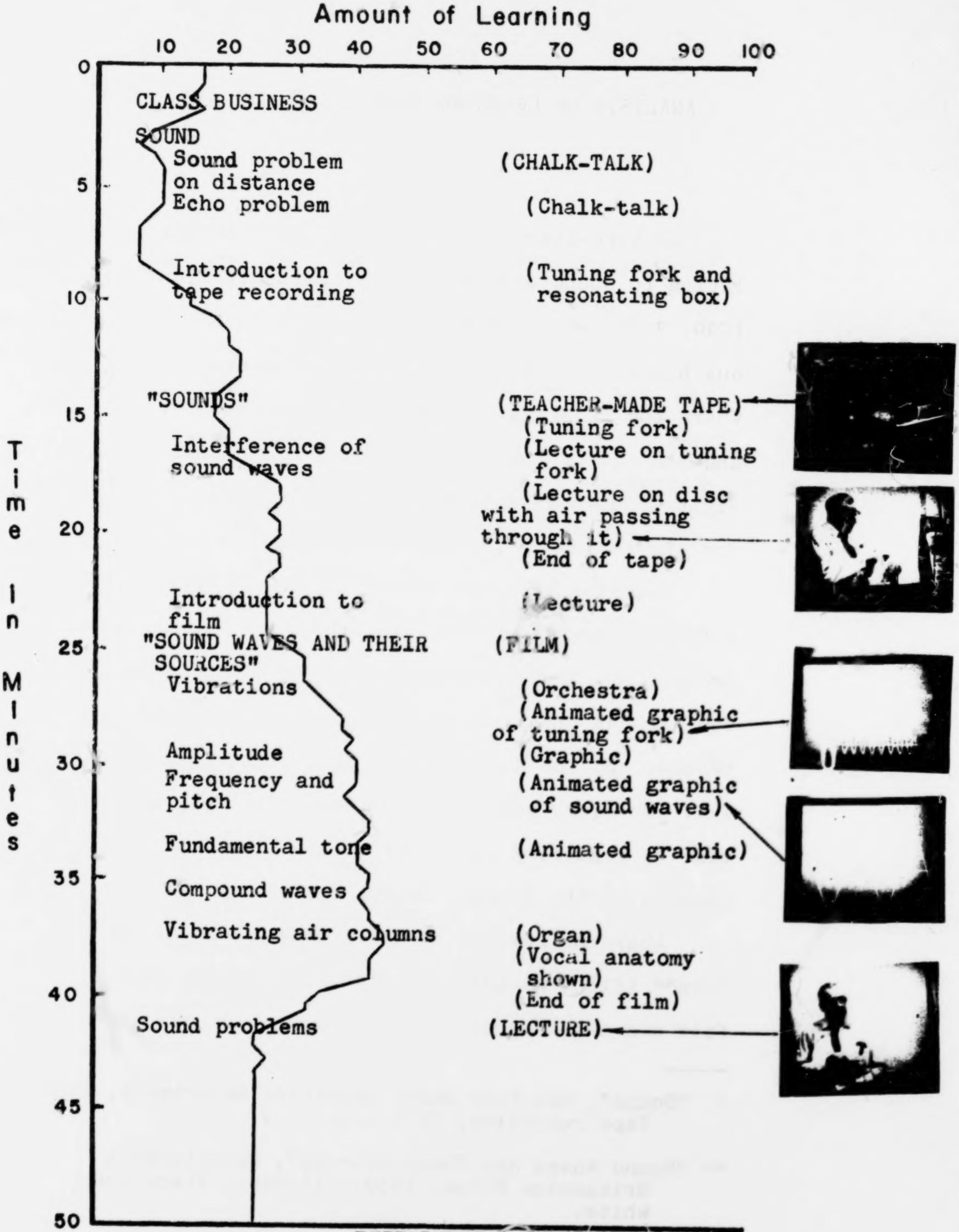
"Waves and Pitch", Transparency V. I., same as above.

"Problems", Transparencies V. J., V. K., V. L., V. M., same as above.



CONTROL GROUP

LEARNING PROFILE NUMBER 99



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 100

ANALYSIS OF LEARNING PROFILES 99 AND 100

Lecture-discussion on how to do problems relating to sound was greater in the Control Group (C99, 3-20) where they were taken up in one continuous block of time than in the Experimental Group where the problems were discussed at the beginning and the end of the class (E100, 3-8 and 42-46) with eight minutes less time for the Experimental Group for the topic.

Learning reached almost the same level whether different sounds were presented "live" in the Control Group (C99, 21-37) or by a tape recording* of the same sounds prepared, with explanations, by the teacher and the audio-visual specialist (E100, 14-21). However, the tape provided a decided saving of time by requiring only 7 minutes as compared to 16 minutes in the Control Group.

Learning reached a significant level in the film** (E100, 25-40). The learning during this film was much higher than during lecture and discussion and simple demonstrations on the same topic in the Control Group (C97, 18-25 and C95, 11-22).

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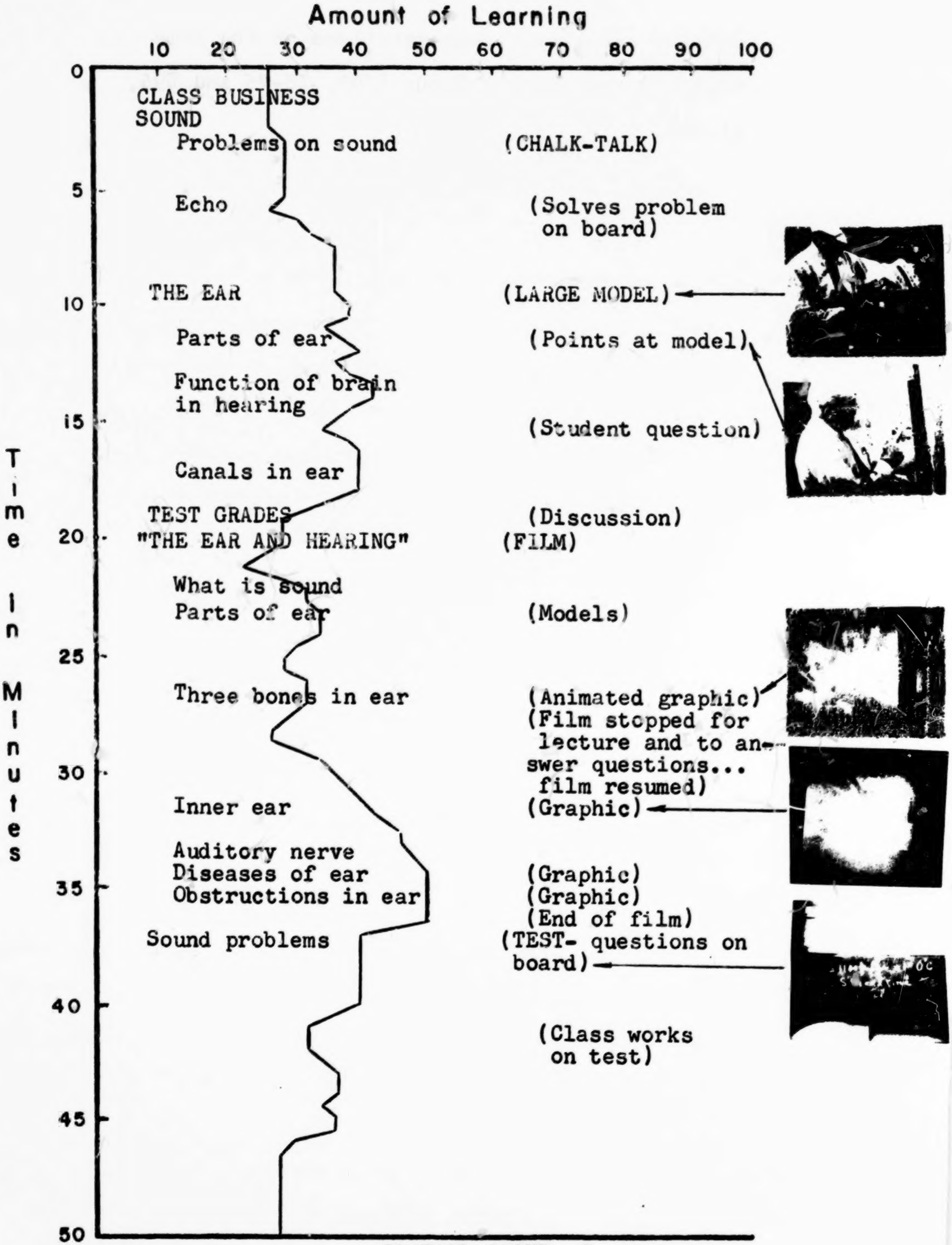
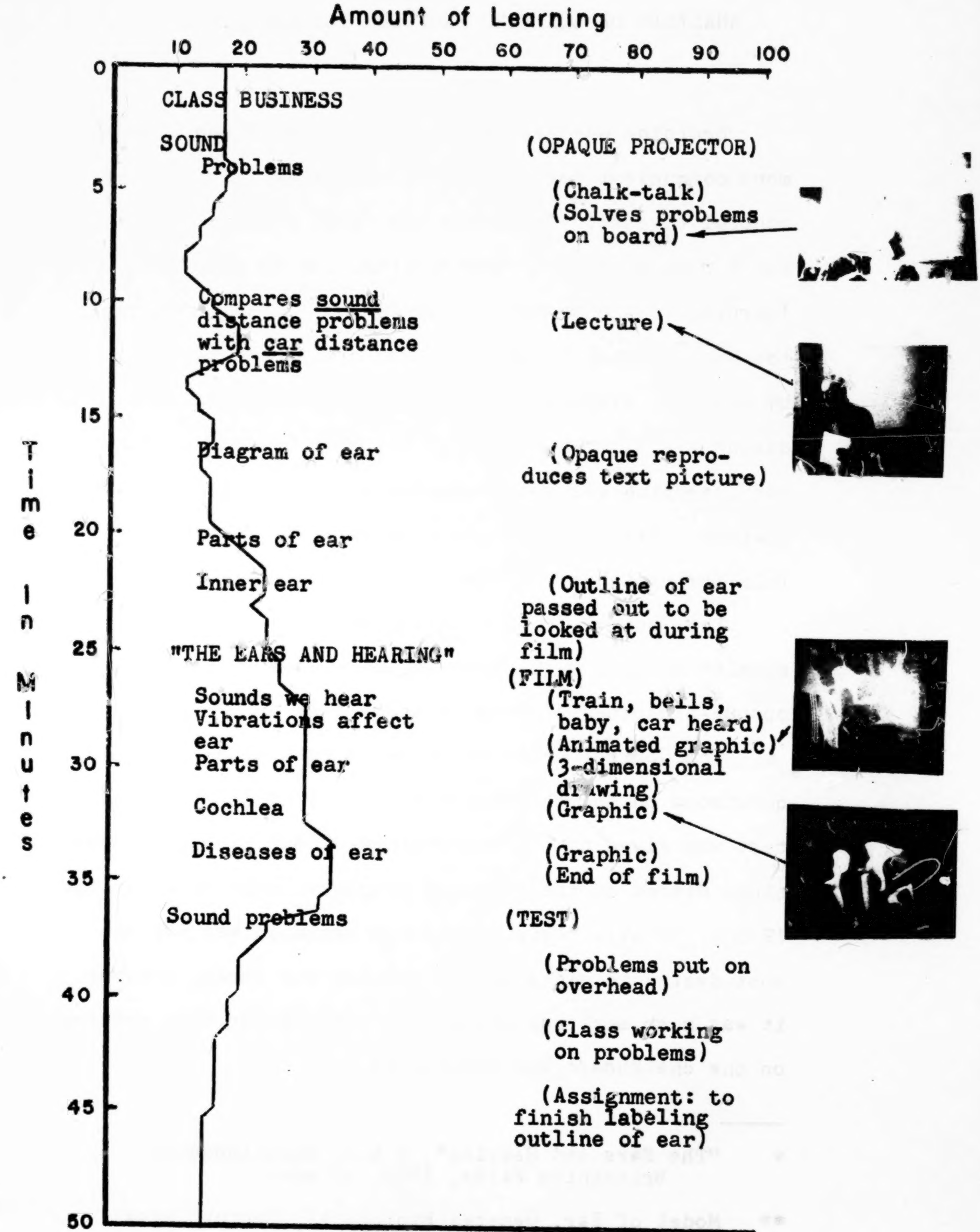
* "Sound", New York State Education Department, 1960. Tape recording, 7½ i.p.s.

** "Sound Waves and Their Sources", Encyclopedia Britannica Films, 1950. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 101



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 102

ANALYSIS OF LEARNING PROFILES 101 AND 102

Learning was greater in the Control Group because more communications media were used than in the other control classes. Therefore the film* shown, since it was a regular part of instruction, led to greater learning in the Control Group (C 101, 20-37) than in the Experimental Group (C 25-35). Also the teacher, by mistake, stopped the film to make explanations during the film which should not have been done since such stopping was not a regular part of instruction. However, this did show the advantage of stopping the film for explanations over running it straight through.

The Control Group studied the ear by means of a model** (C 101, 9-17) learning more than by seeing an opaque-projected diagram (E 102, 17-21).

The Control Group was given a test with the questions on the chalkboard (C 101, 37-47). The same test was given to the Experimental Group with the questions placed on the overhead projector with no advantage (E 102, 37-47). This use of the overhead was not the most desirable since merely writing was shown; however, it was much more convenient for the teacher than writing on the chalkboard and erasing it.

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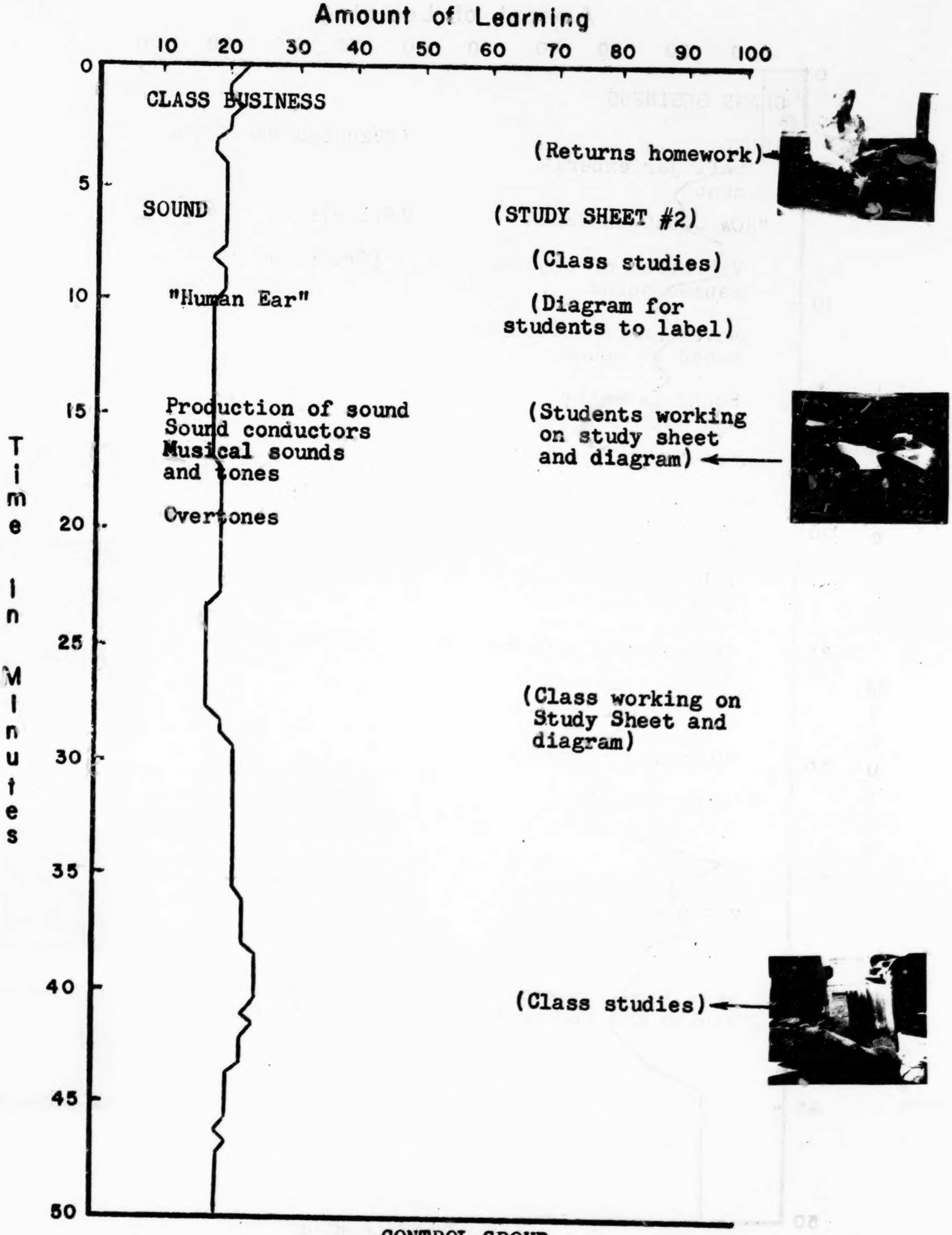
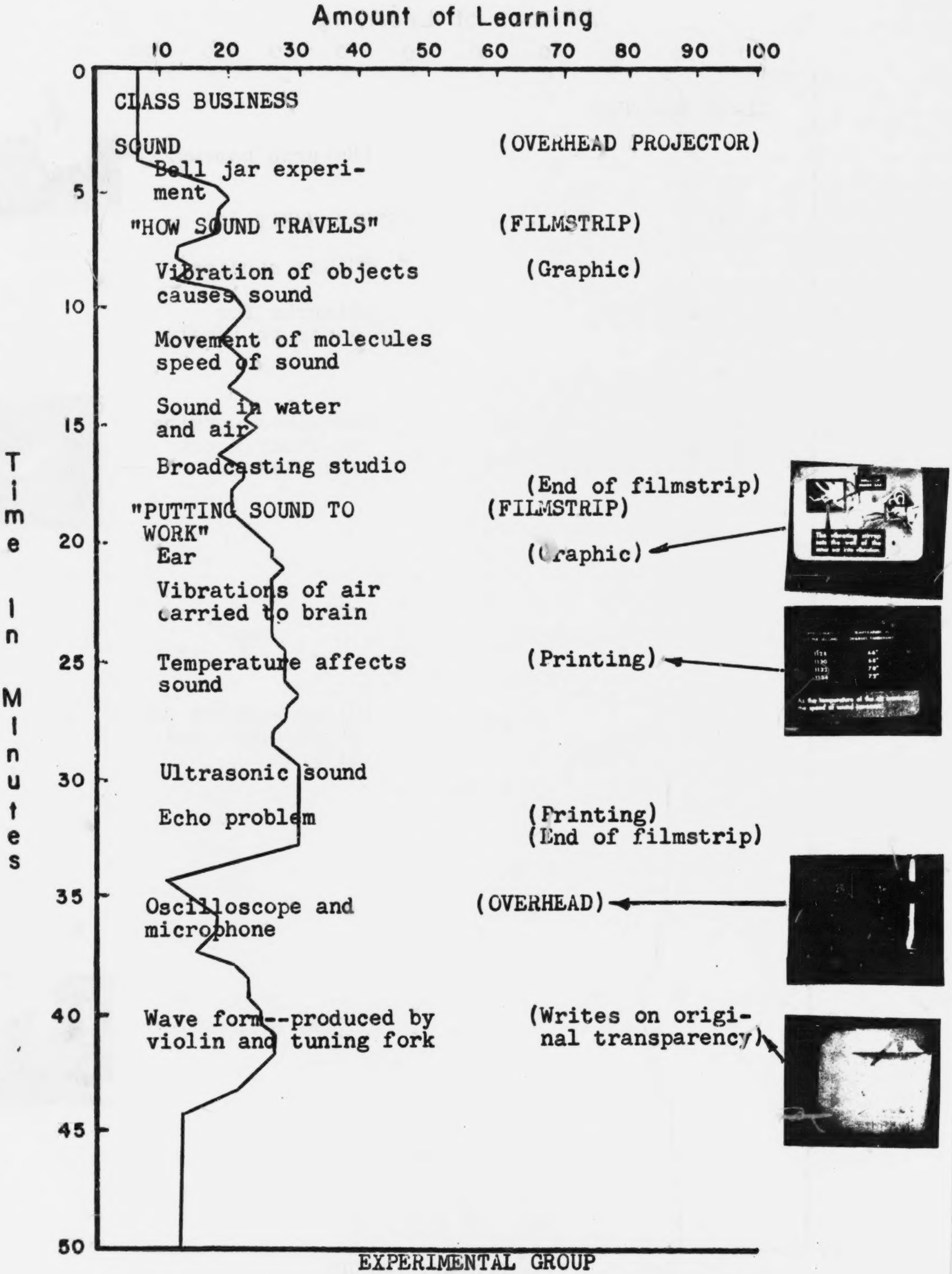
* "The Ears And Hearing", b & w, Encyclopaedia Britannica Films, 1949, 10 min.

** Model of Ear, General Biological, Turtox Latex Models Supply House, multicolor.



CONTROL GROUP

LEARNING PROFILE NUMBER 103



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 104

ANALYSIS OF LEARNING PROFILES 103 AND 104

Student study by means of the newer media was generally more effective than by study of the text and drawing a diagram.

An illustration placed on an overhead transparency* by a direct copying process was not sufficiently clear although learning did reach the 20 per cent level.

A filmstrip** led to higher learning (E104, 8-19) than text study of the same topic. Even higher learning resulted from a filmstrip*** which showed some applications (E104, 20-32).

Learning in the Experimental Group with overhead transparency# and a slide## was approximately the same as in the Control Group.

---

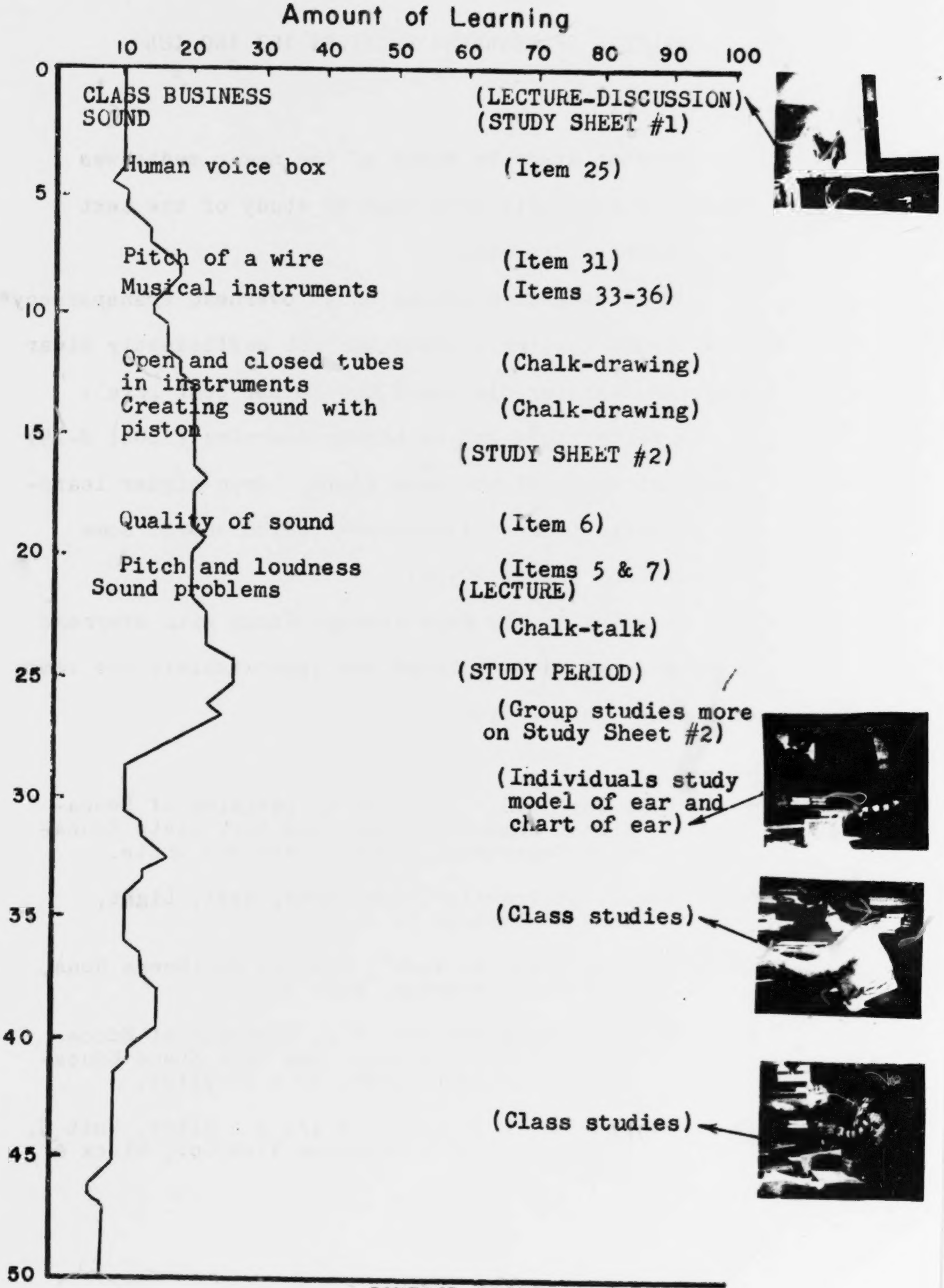
* "Bell Jar", 10 x 10 Slide V, Division of Educational Communications, New York State Education Department, 1960, black and white.

** "How Sound Travels", Jam Handy, Heat, Light, Sound-Filmstrip 7.

*** "Putting Sound to Work", Charles Scribners Sons, Speaking & Hearing, Part B.

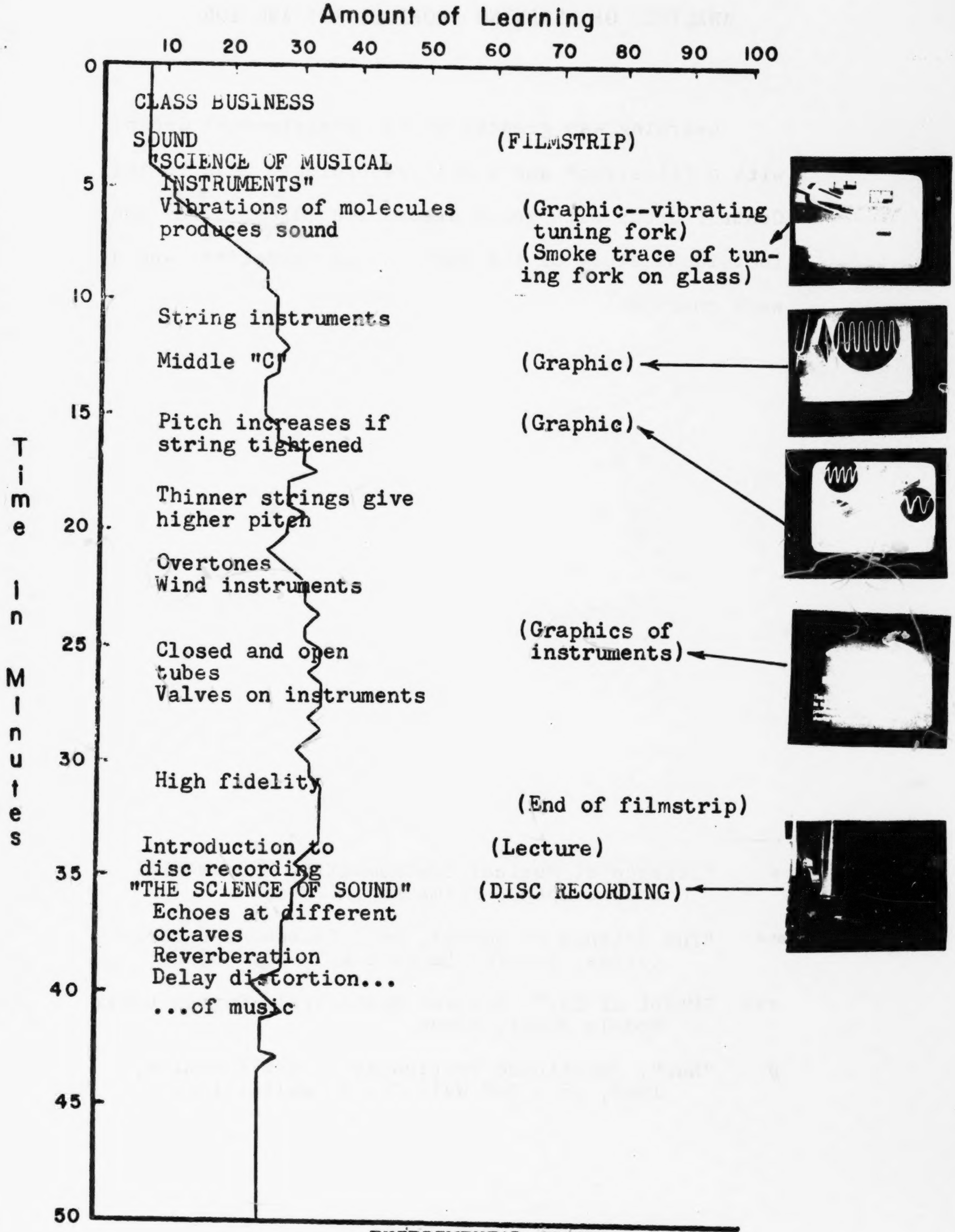
"Piano & Oscilloscope", V A, Division of Educational Communications, New York State Education Department, 1960, 10 x 10 slide.

## "Sound-Singing Strings", 3 1/4 x 4 Slide, Unit C, (L54010), (145), Keystone View Co., black & white.



CONTROL GROUP

LEARNING PROFILE NUMBER 105



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 106

ANALYSIS OF LEARNING PROFILES 105 AND 106

Learning was greater in the Experimental Group with a filmstrip* and a disc recording** than in the Control Group with group discussion (C105, 3-24) and individual study of the text, an ear model***, and a wall chart.#

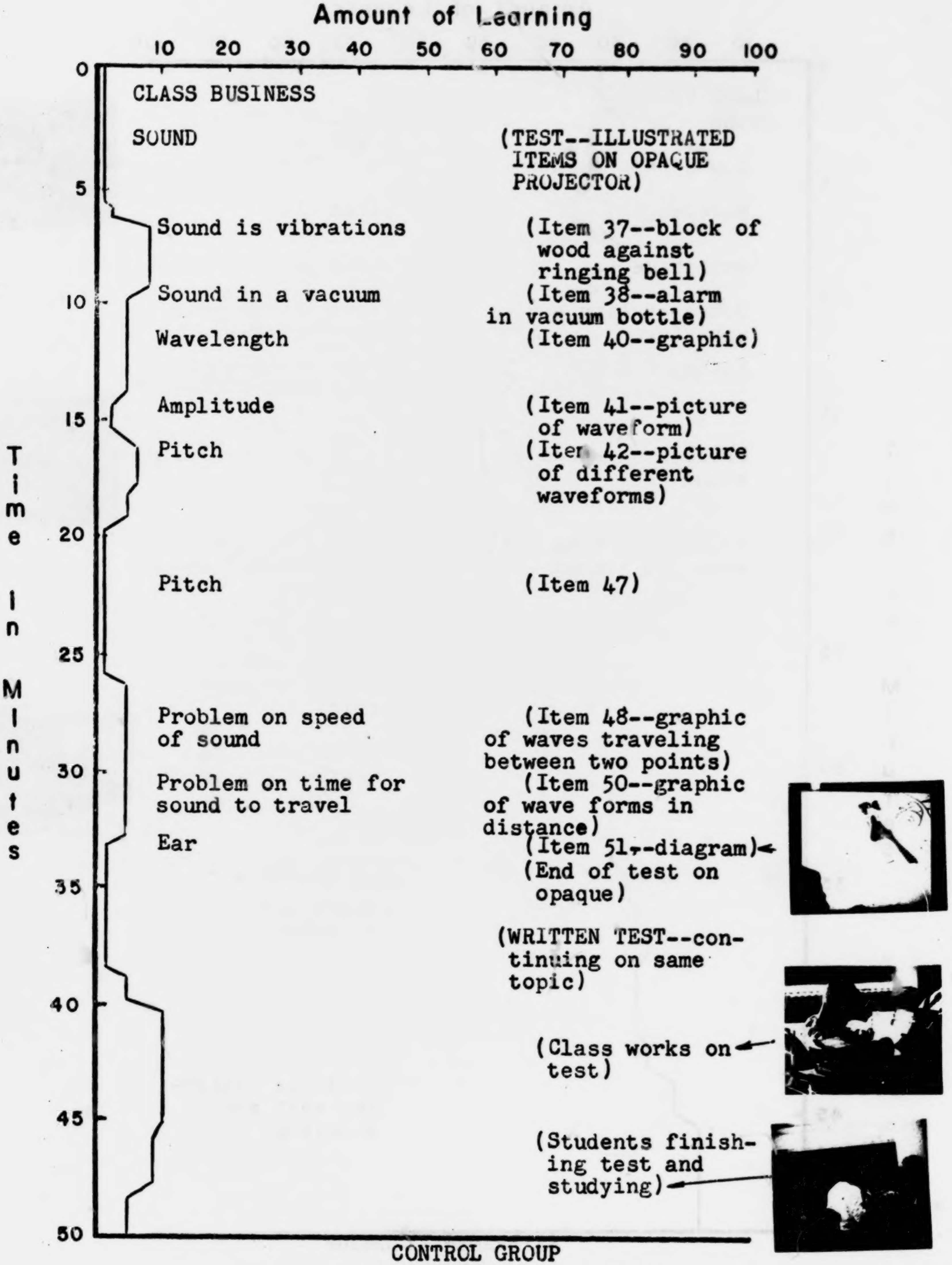
---

* "Science of Musical Instruments", McGraw-Hill Book Company, filmstrip, (299552).

** "The Science of Sound", Bell Telephone Laboratories, record, Bands 6 & 7, part of 8.

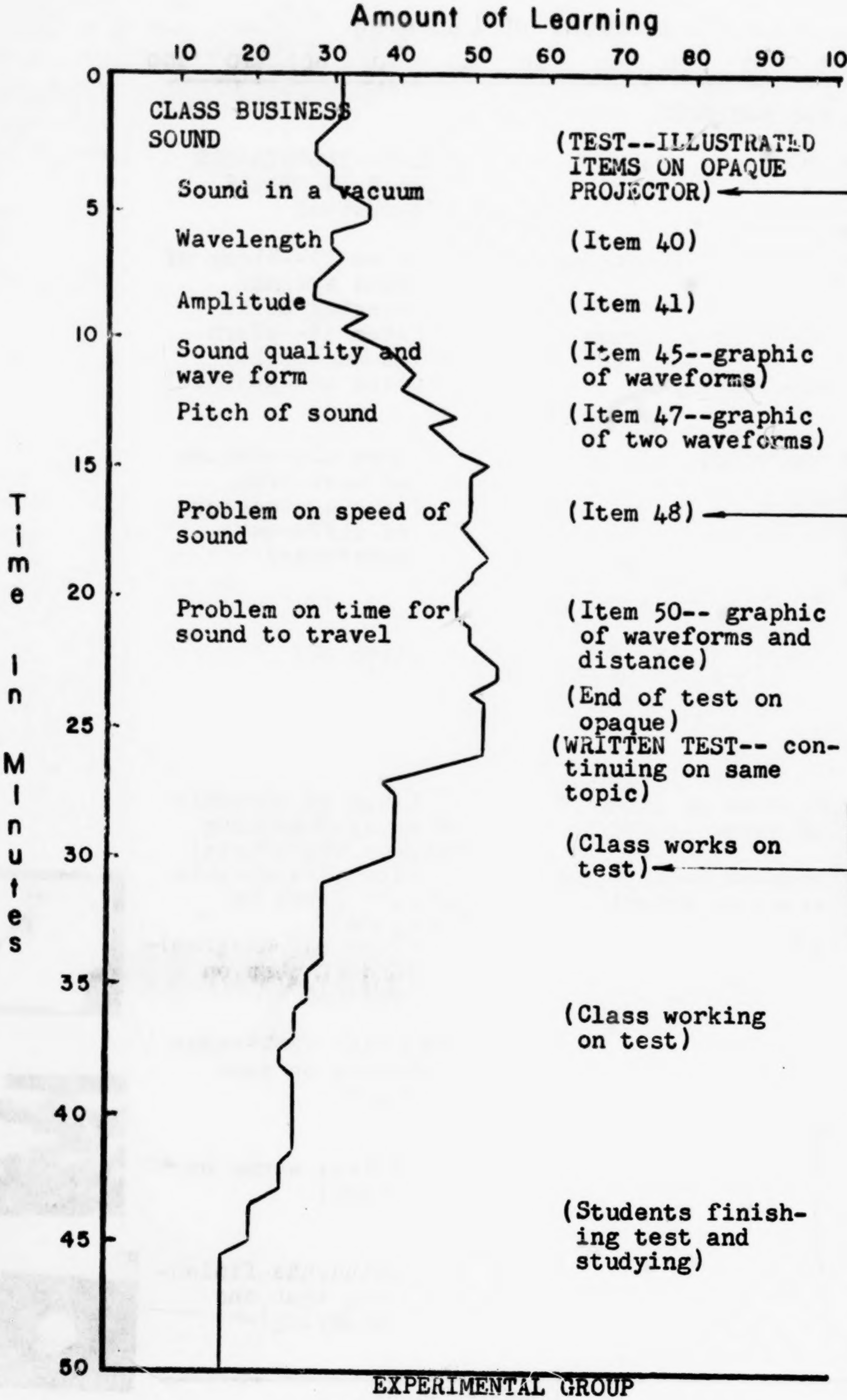
*** "Model of Ear", General Biological, Turtox Latex Models Supply House.

# "Ear", (sectioned vertically), Rudolf Schick, 1940, 46 x 30" Wall Chart, multicolor.



CONTROL GROUP

LEARNING PROFILE NUMBER 107

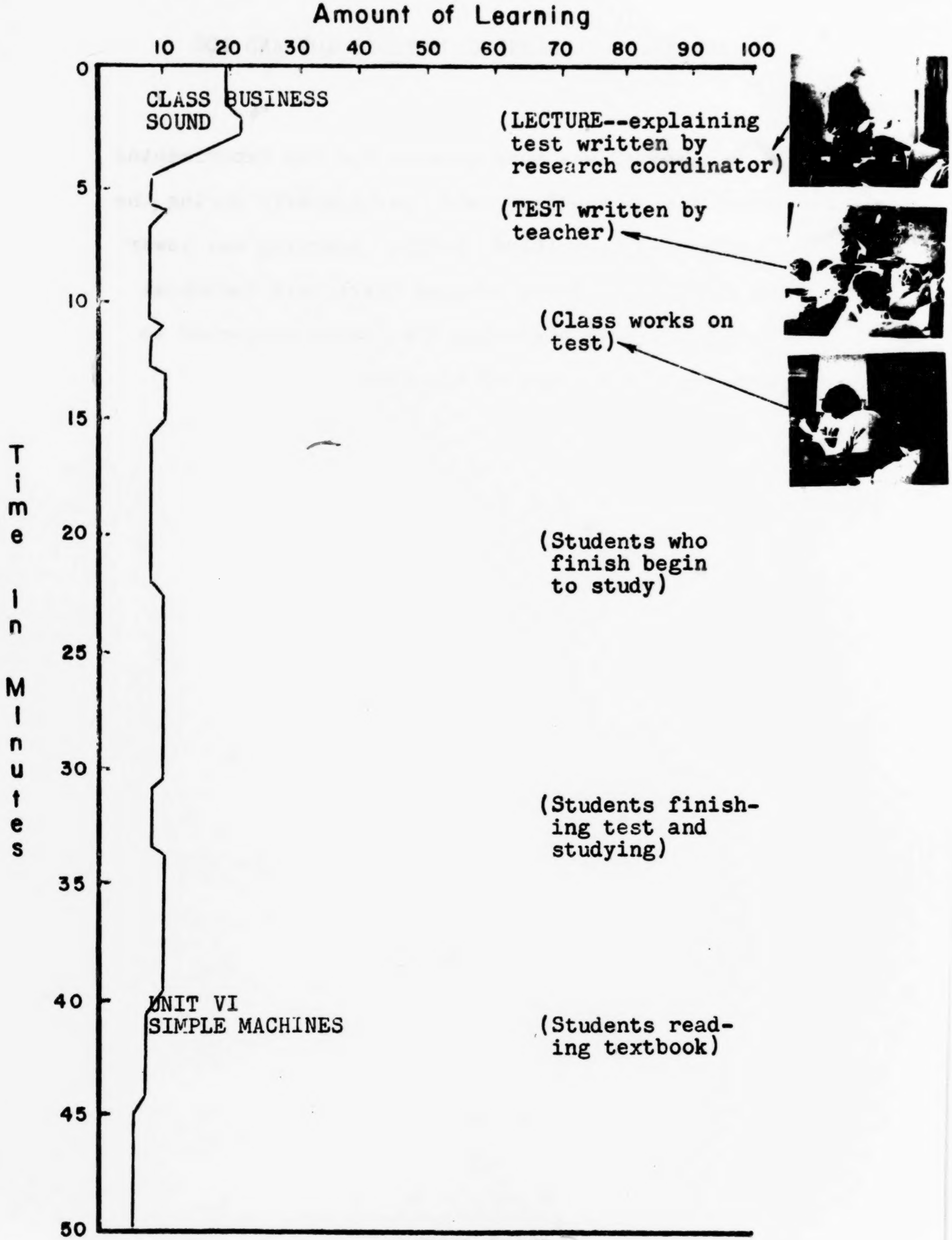


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 108

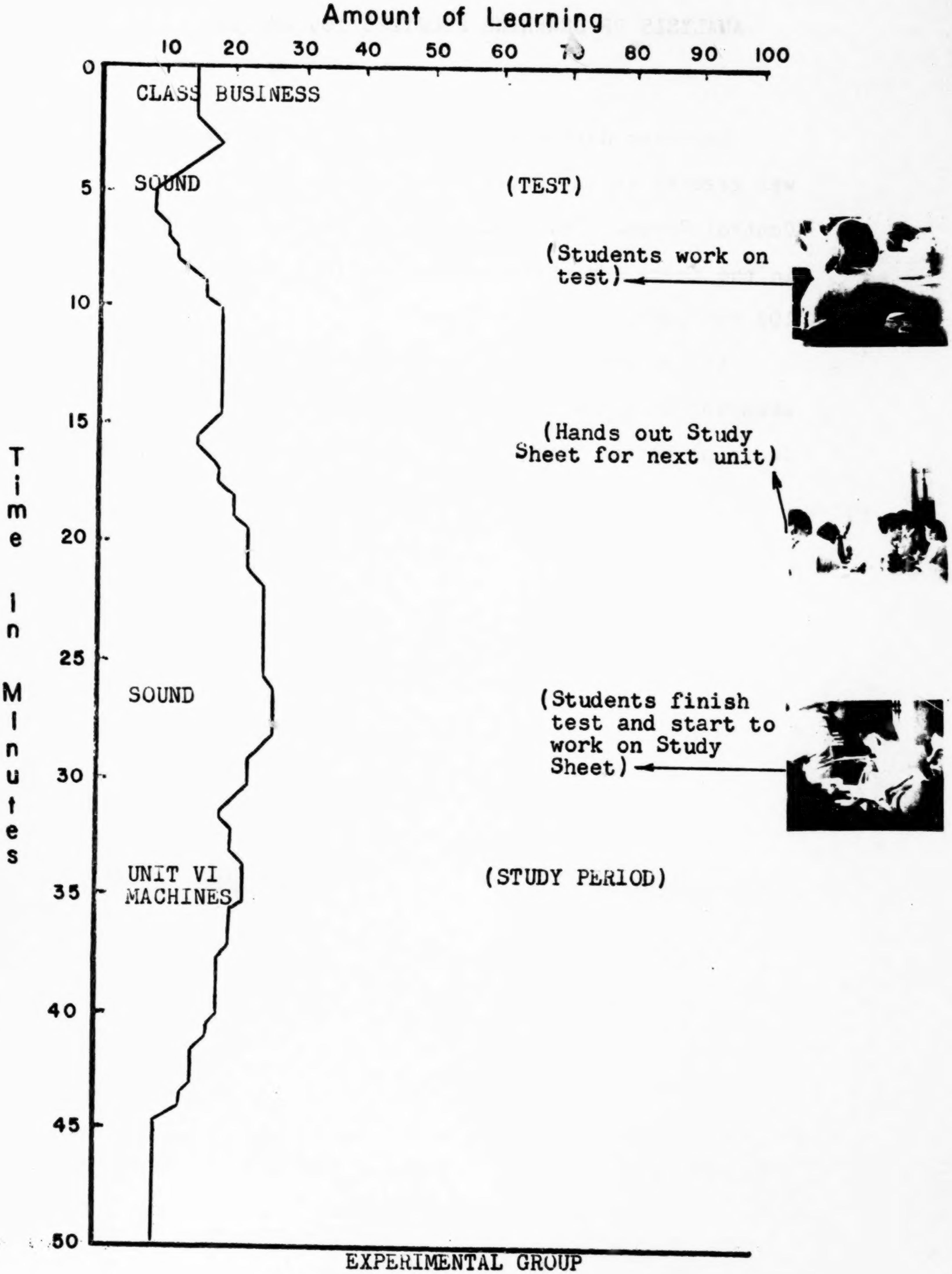
ANALYSIS OF LEARNING PROFILES 107 AND 108

Learning was much greater for the Experimental Group during the test, and, particularly during the illustrated part (E108, 3-25). Learning was lower in the Control Group because there were technical difficulties in operating the opaque projector to show the visual part of the test.



CONTROL GROUP

LEARNING PROFILE NUMBER 109



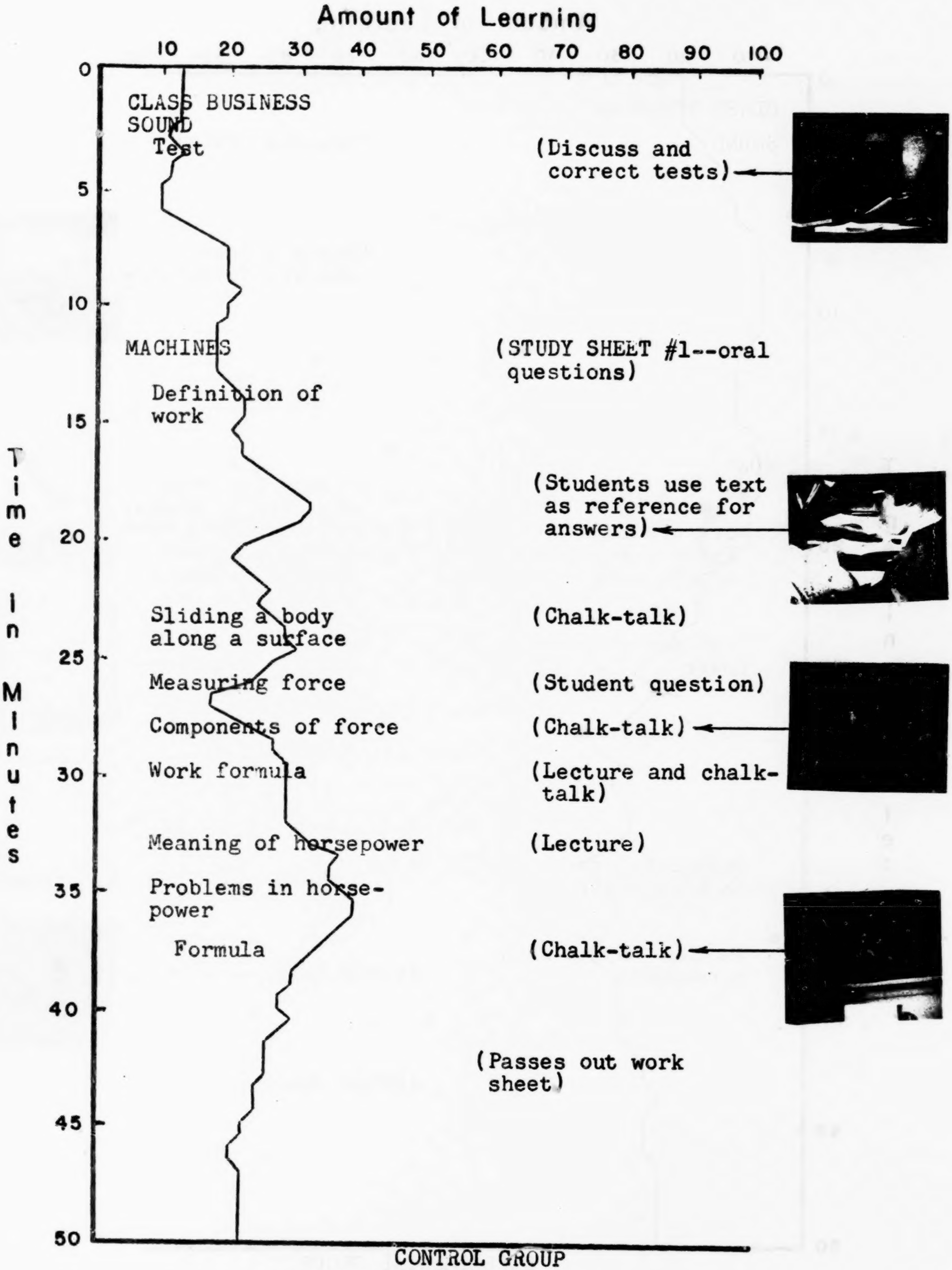
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 110

ANALYSIS OF LEARNING PROFILES 109 AND 110

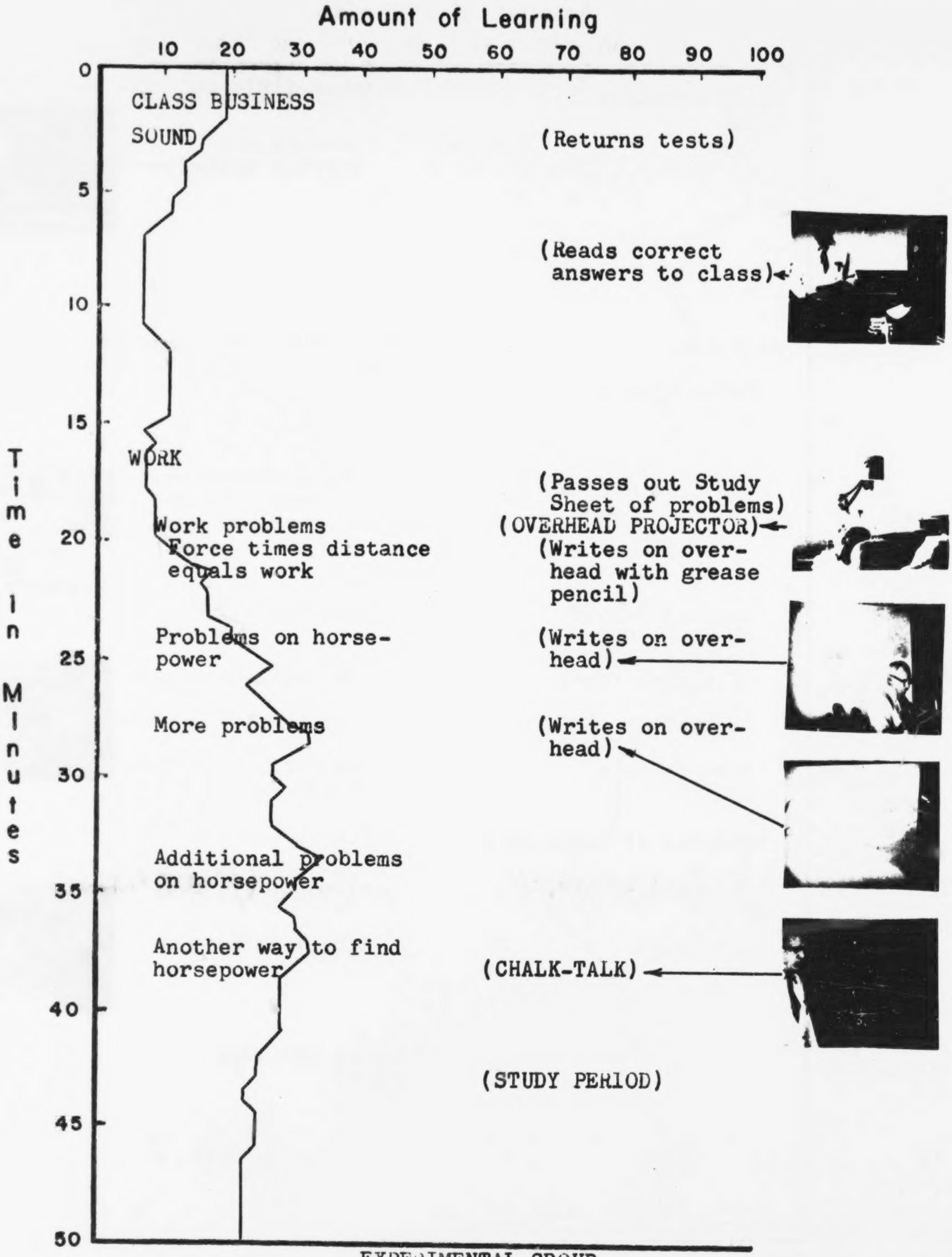
Learning during a test written by the teacher was greater in the Experimental Group than in the Control Group. This followed the pattern established in the tests administered the previous day (Profiles 107 and 108).

At the end of the class when both groups began studying on a new unit by means of the textbook, learning became lower (C109, 40-47 and E110, 35-45).



CONTROL GROUP

LEARNING PROFILE NUMBER 111



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 112

ANALYSIS OF LEARNING PROFILES 111 AND 112

Tests were returned to both groups. Learning was greater in the Control Group because the students were more involved in discussing and correcting the test themselves (C111, 3-10) whereas the Experimental Group was merely given the answers (E112, 9-15).

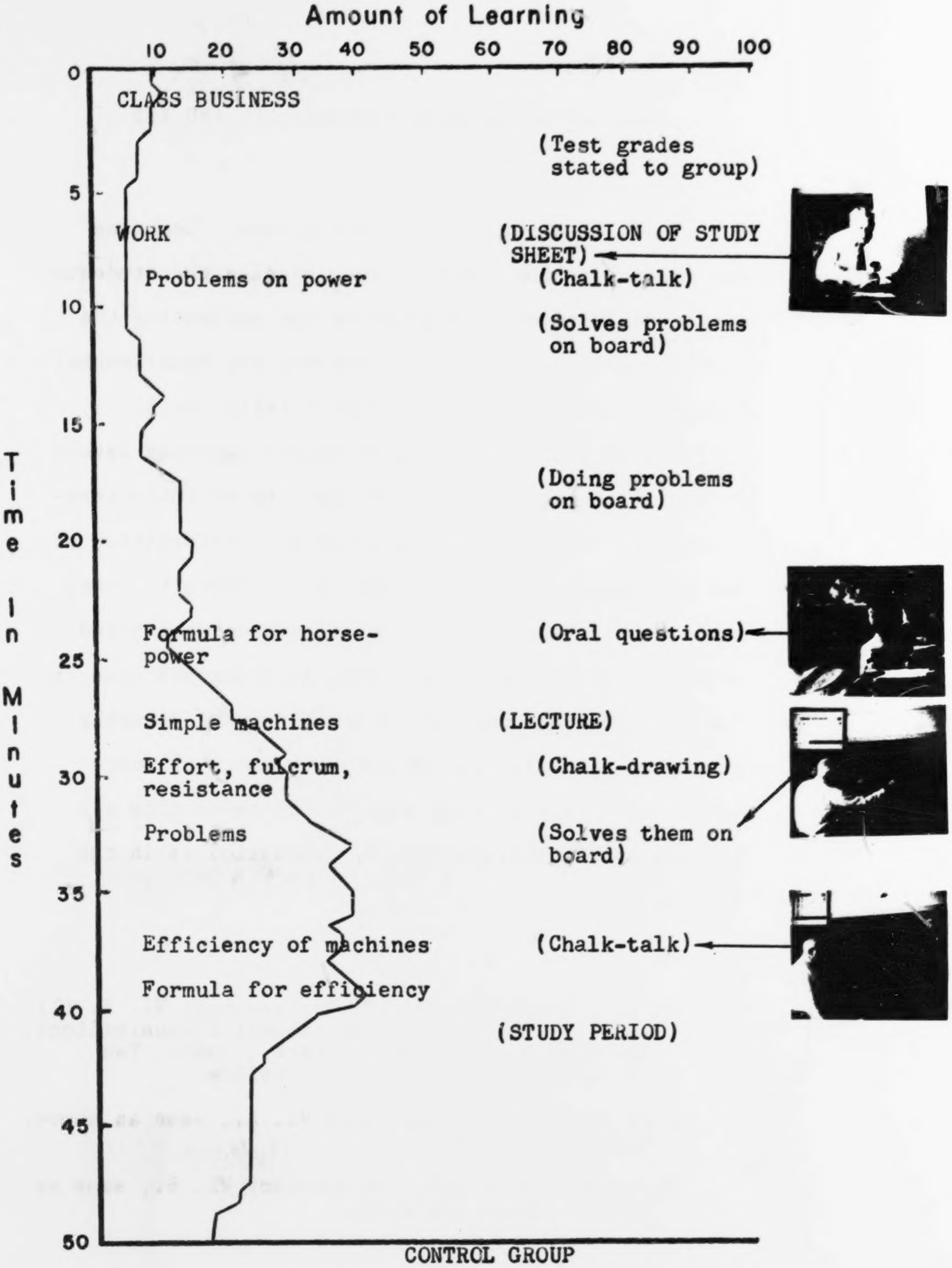
The Control Group reached higher learning levels by discussion of a study sheet devised to guide textbook study because the discussion gave information of use in answering the sheet and in the tests to come, which the students by now had discovered were based primarily on the textbook. Also learning was less in the Experimental Group where the class was abruptly presented with problems on work--by means of overhead transparencies*--in contrast to developing a background for the problems by discussion as in the Control Group.

---

* "Force x Distance = Work", Transparency VI. K. (1) and (2), Division of Educational Communications, New York State Education Dept., 1960. Two 10" x 10" slides, black and yellow.

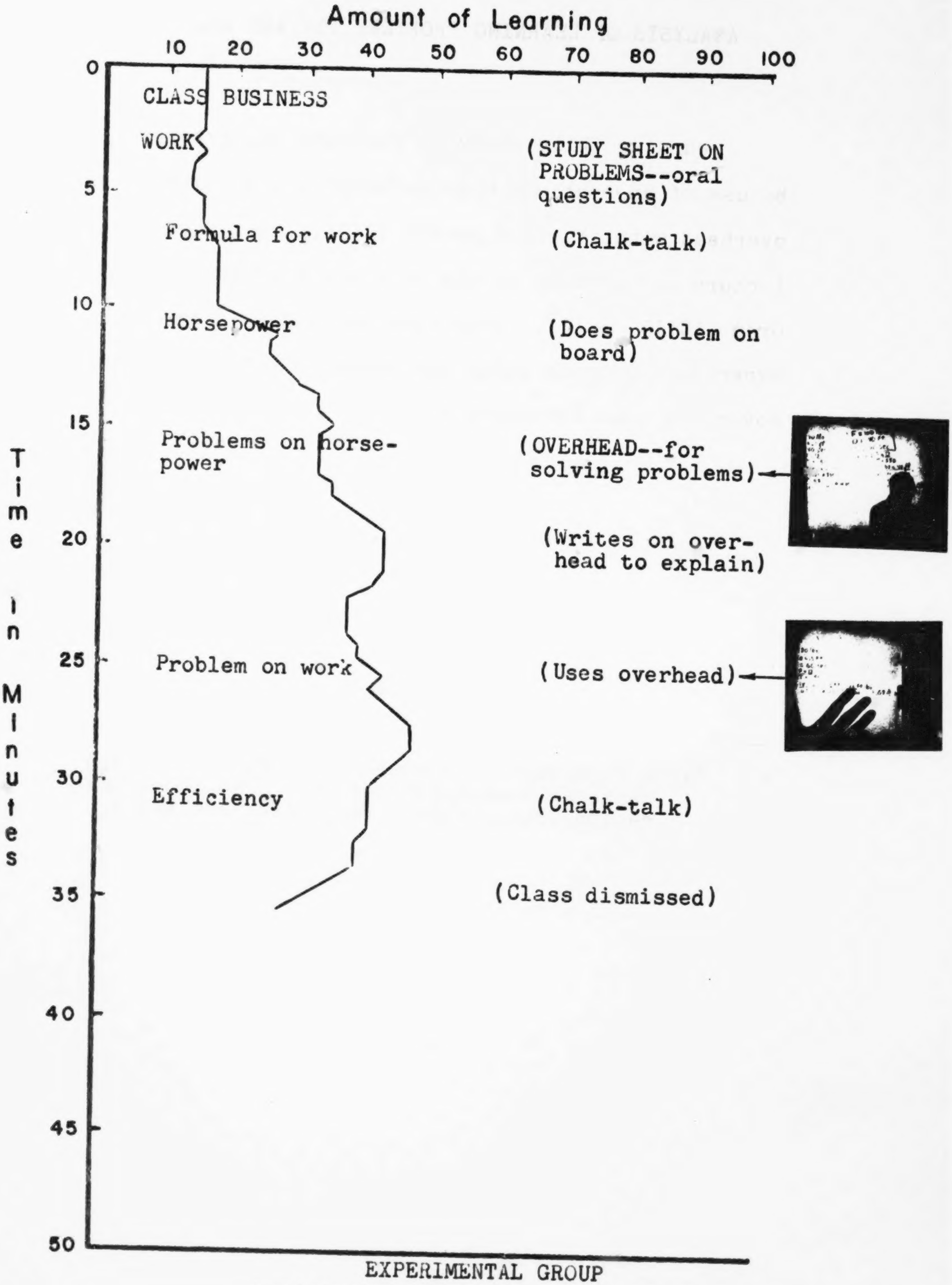
"Work Problem", Transparency VI. A., same as above. Black and white.

"Horsepower Problem", Transparency VI. B., same as above. Black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 113



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 114

ANALYSIS OF LEARNING PROFILES 113 AND 114

Learning while studying problems was greater by use of an overhead transparency* and writing on the overhead with a grease pencil (E114, 17-31) than by lecture and writing on the chalkboard in the Control Group (C113, 9-41). Less time was taken in the Experimental Group using the overhead projector to cover the same information.

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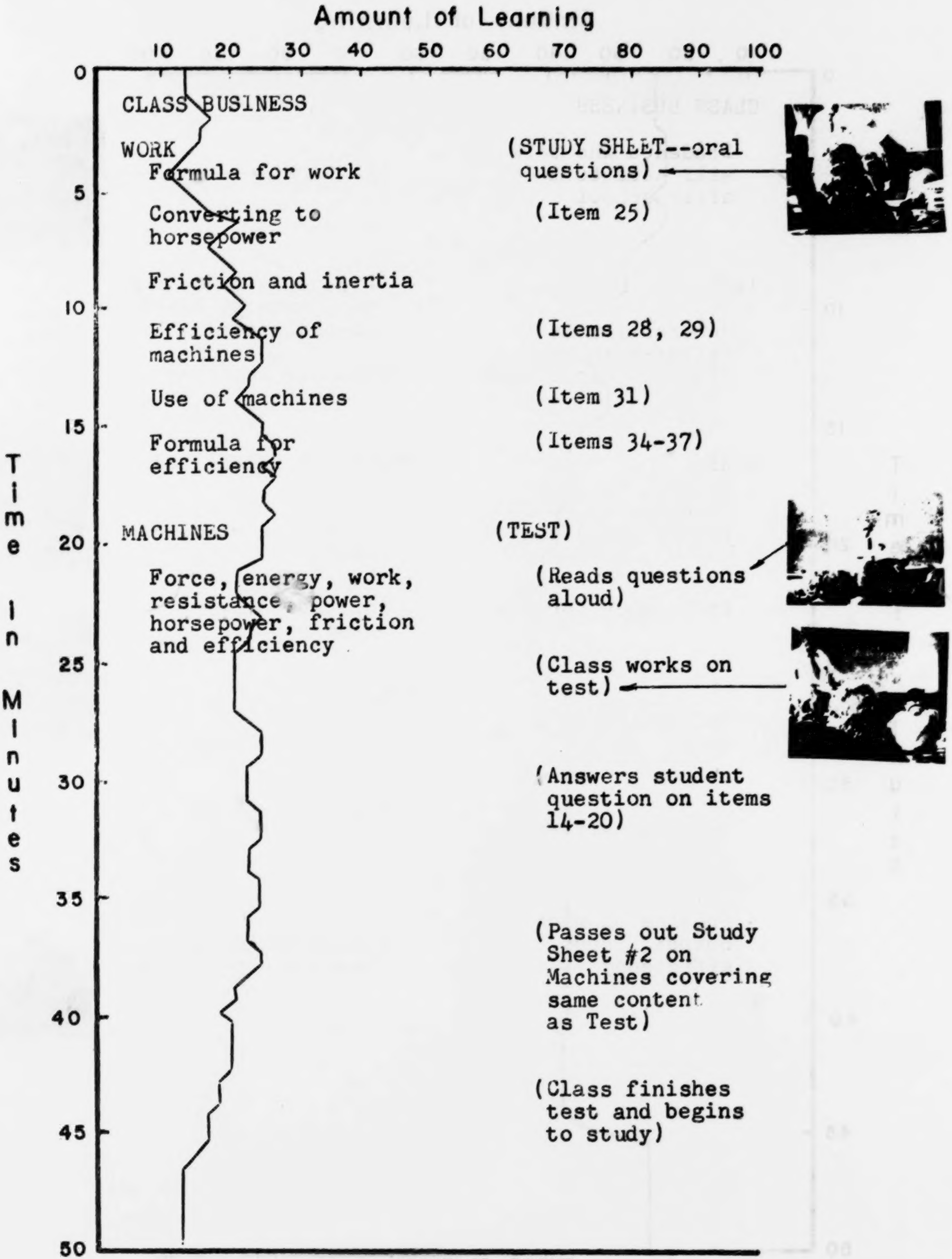
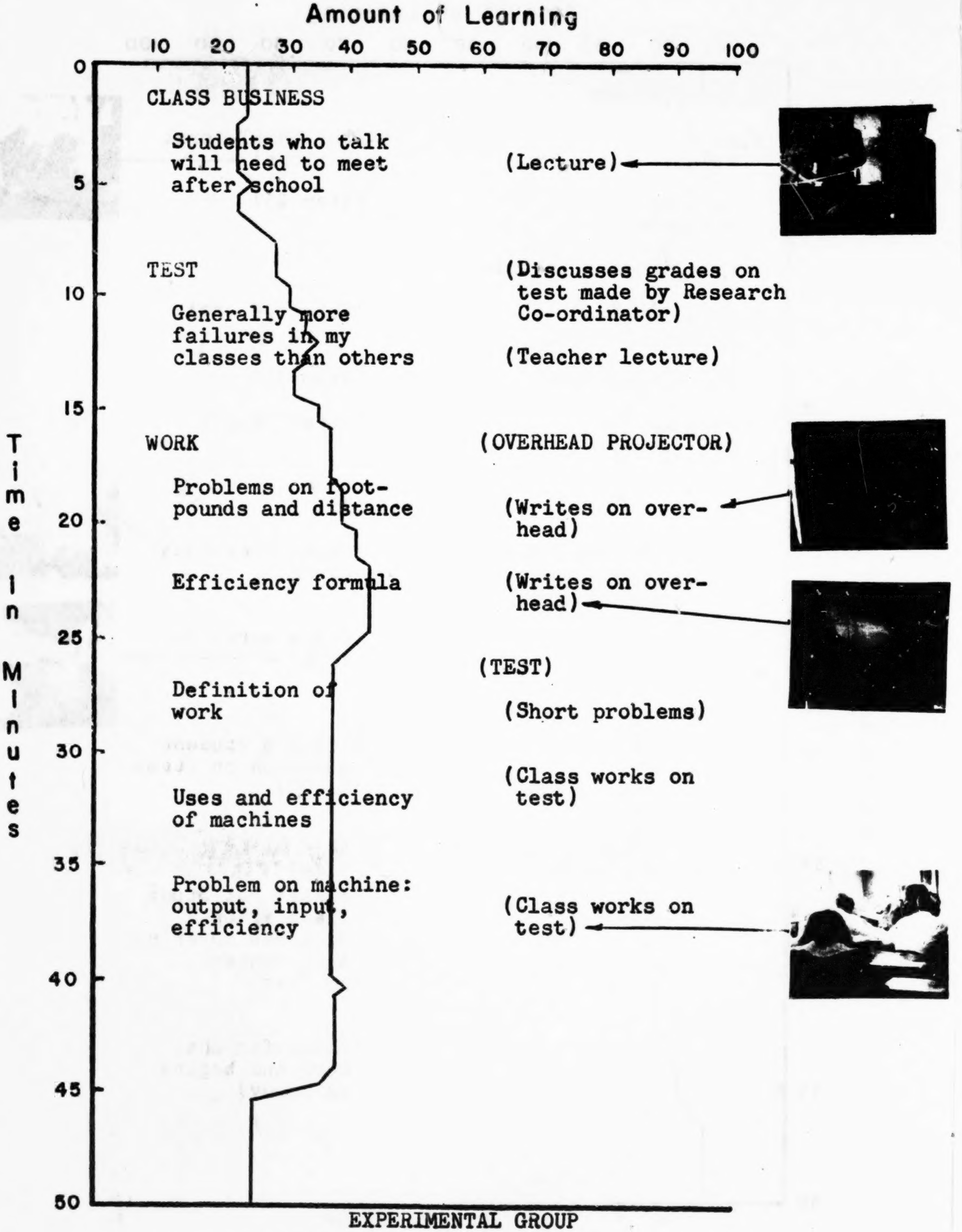
* "Work Problems", transparency, Division of Educational Communications, New York State Education Dept., 1960. VI-C, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 115



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 116

ANALYSIS OF LEARNING PROFILES 115 AND 116

Learning was greater in the Experimental Group where an overhead transparency* was used a second time and problems were worked by the teacher with a grease pencil (E116, 17-27). In the Control Group questions from the study sheet were asked by the teacher (C115, 3-18).

With the background presented by the overhead projector, the Experimental Group learned more during a test (E116, 27-46 as compared to C115, 19-42).

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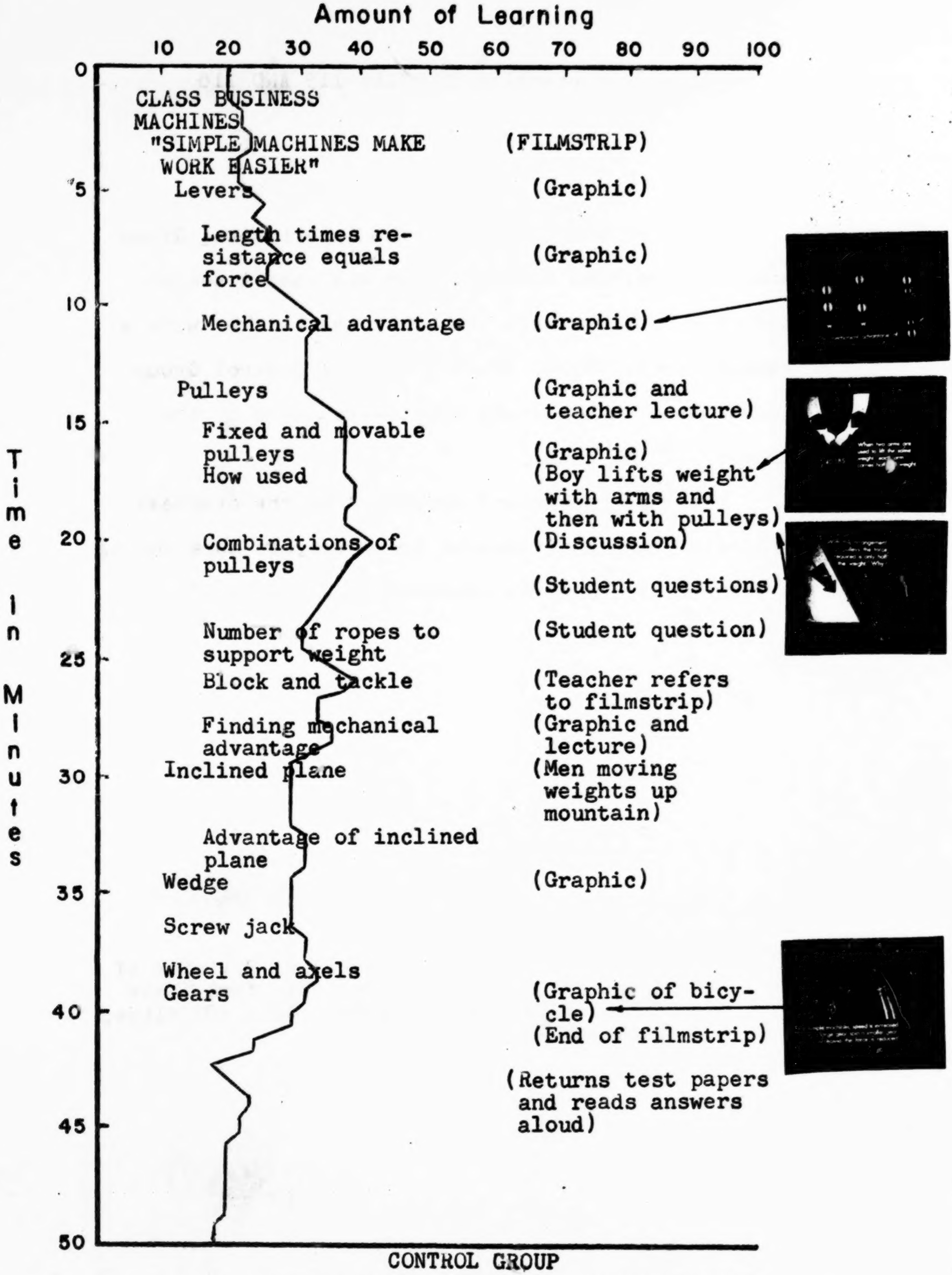
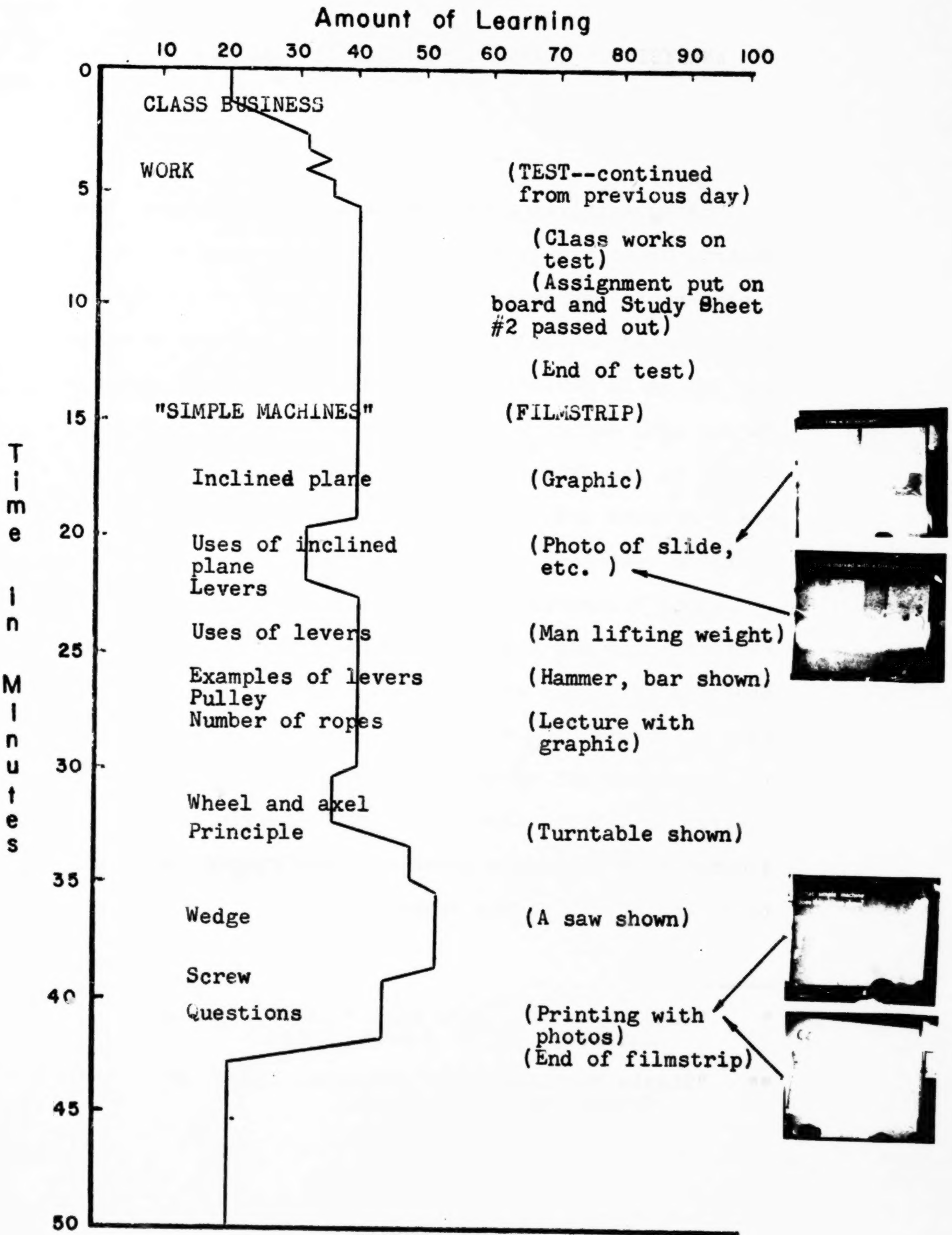
* "Work Problems", Transparency VI. K., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 117



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 118

ANALYSIS OF LEARNING PROFILES 117 AND 118

Because it was a regular part of instruction, the Control Group viewed a filmstrip* which resulted in a considerable degree of learning. A total of 39 minutes were devoted to the filmstrip with the teacher narrating and adding in explanations (C117, 3-42). A filmstrip** on the same topic but by a different producer was presented in the Experimental Group in 30 minutes. This was 9 minutes less than in the Control Group and yet learning reached a higher level (E118, 14-44).

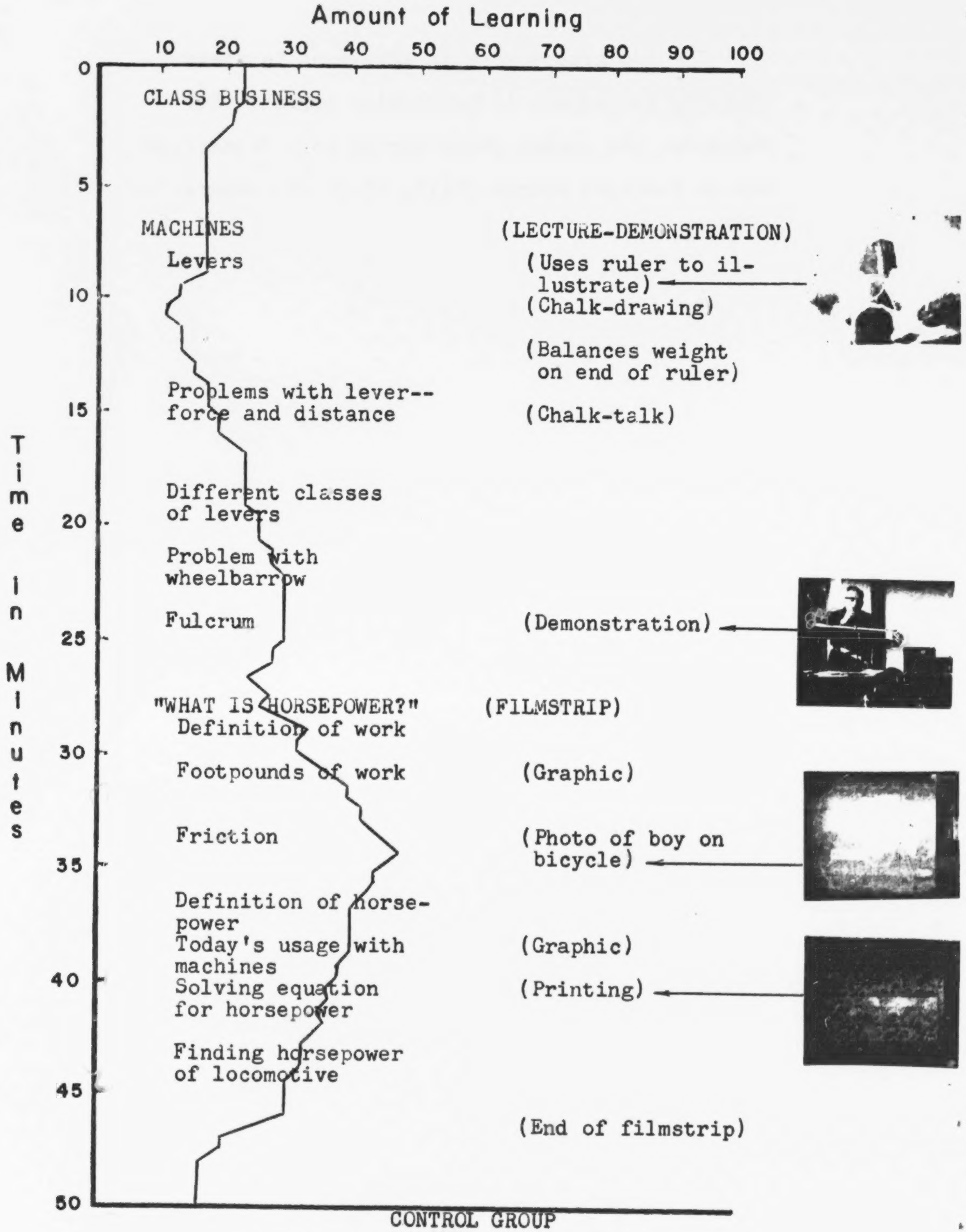
Both filmstrips covered the same information. Factors which may have caused greater learning in the Experimental Group are (1) they had more recent experience in drawing the most from a visual presentation, (2) the black and white filmstrip they viewed had clearer definition than the color filmstrip and (3) the shorter time of presentation may have caused learning to accumulate to higher peaks.

---

* "Simple Machines Make Work Easier", Popular Science, . frames, Color.

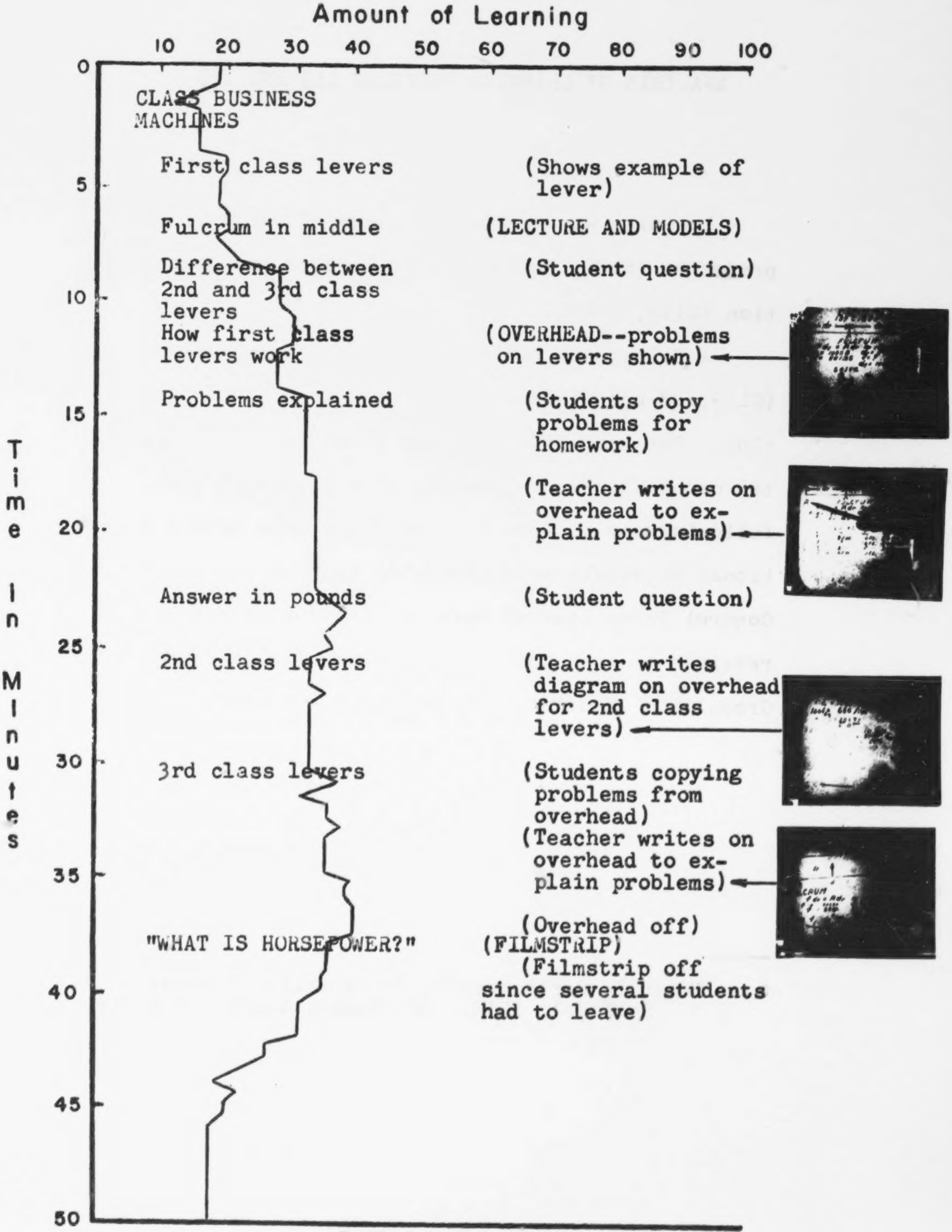
** "Simple Machines", Row Peterson, 1947. 67 frames, black and white.

The two groups were in agreement in their learning in respect to particular topics. For instance, the lowest point during both filmstrips was on inclined planes (C117, 29-32 as compared to E118, 19-22).



CONTROL GROUP

LEARNING PROFILE NUMBER 119



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 120

ANALYSIS OF LEARNING PROFILES 119 AND 120

Learning was greater by means of the overhead projector (E120, 3-28) than by lecture and demonstration (C119, 8-28).

A filmstrip* was shown to the Control Group (C119, 28-45) since it was a regular part of instruction. The same filmstrip was shown to the Experimental Group with less learning (E124, 31-43), thus following the pattern that when the same visual instructional materials were presented to both groups, the Control Group learned more because they had not received as much information as had the Experimental Group with a variety of communications media.

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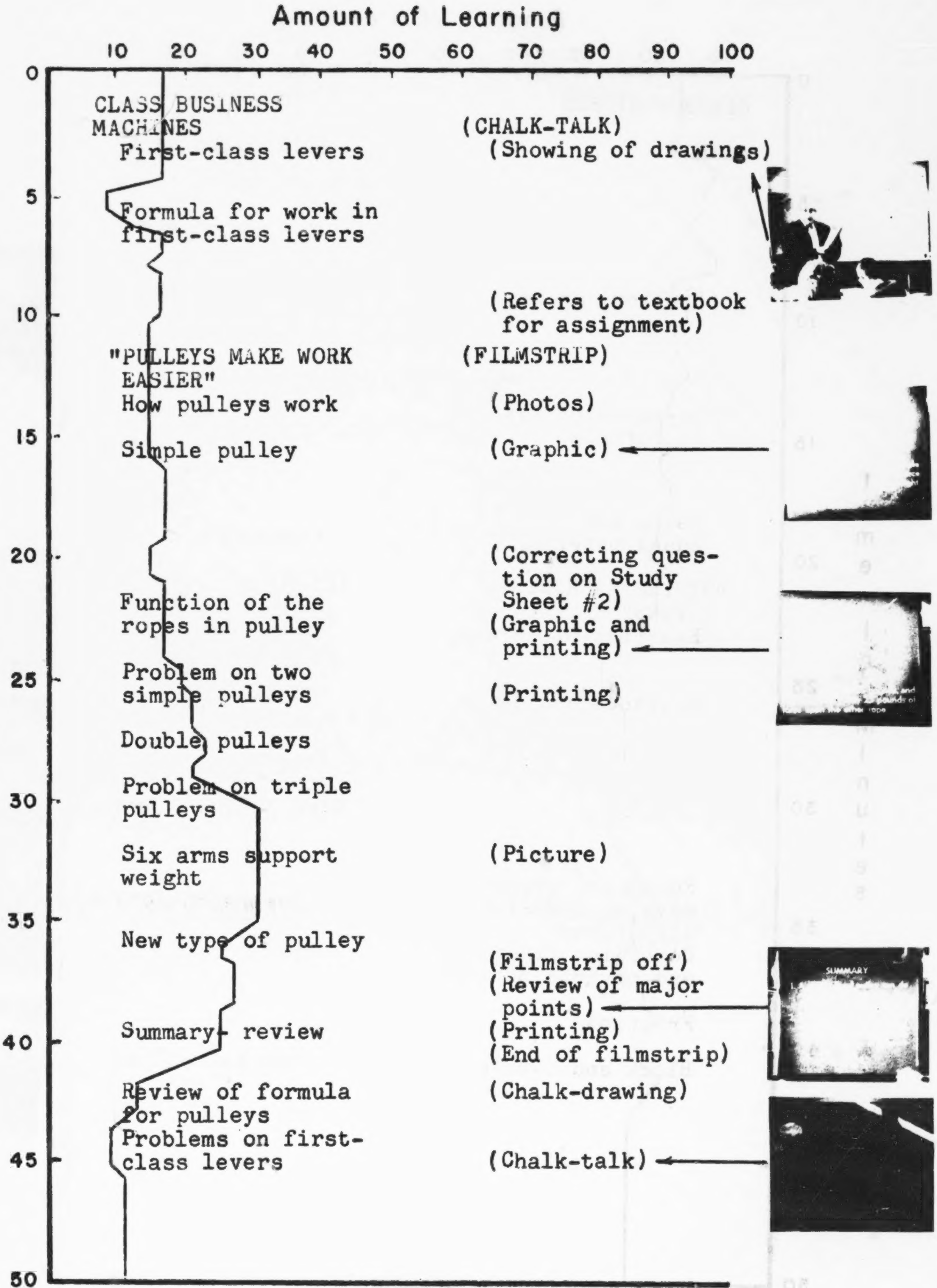
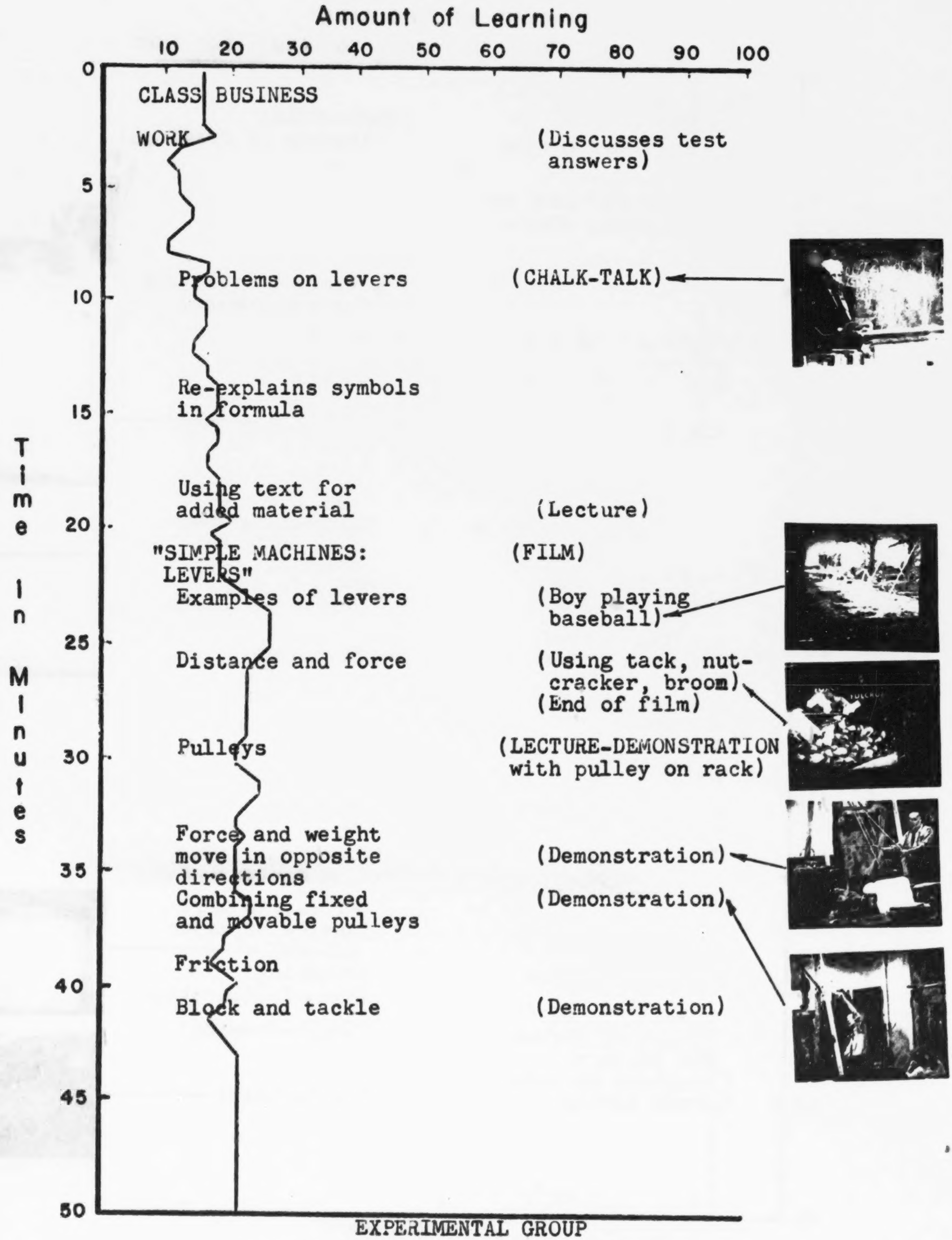
* "What Is Horsepower?", McGraw-Hill (Popular Science), 1950. 52 frames, black and white.



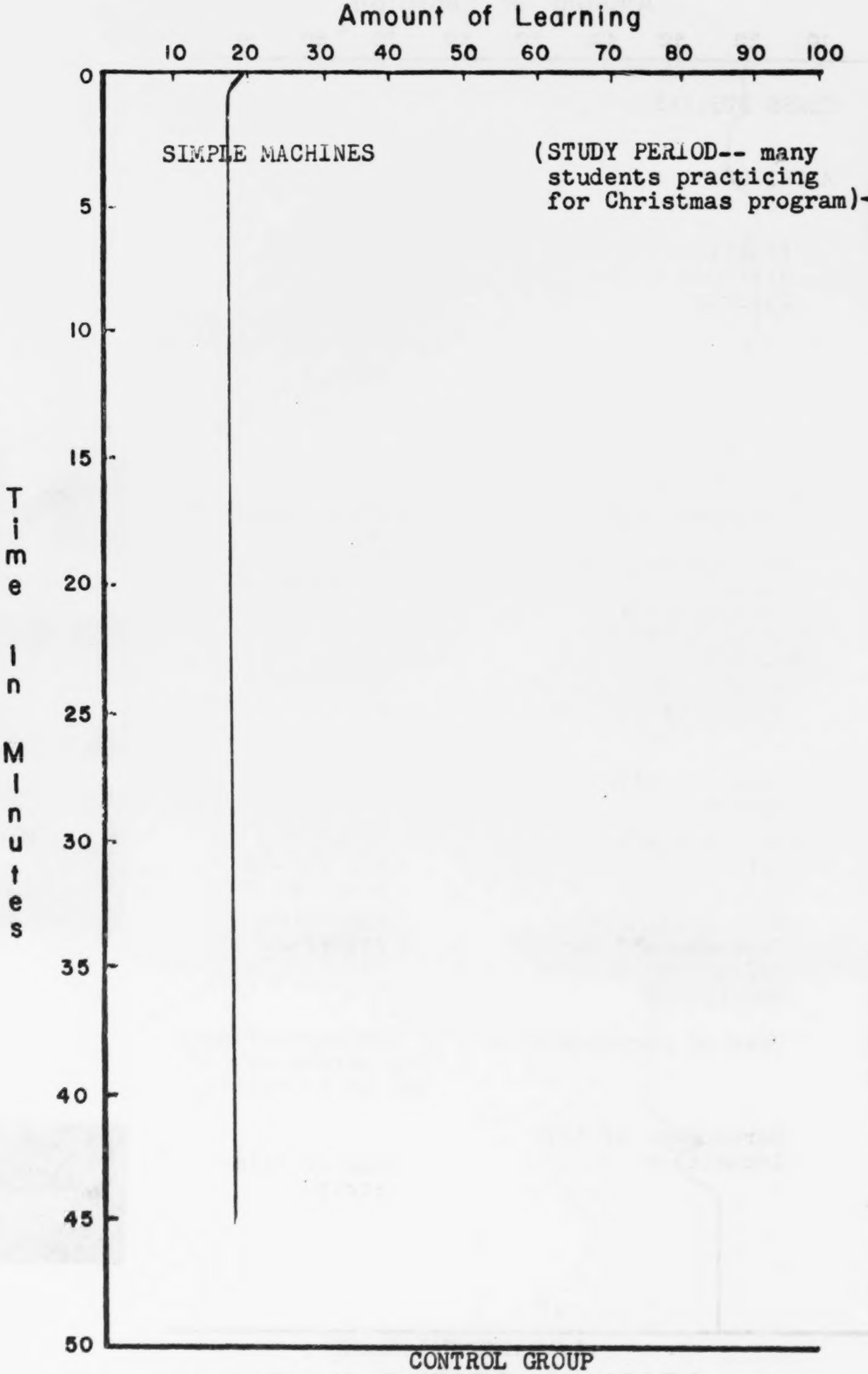
CONTROL GROUP

LEARNING PROFILE NUMBER 121



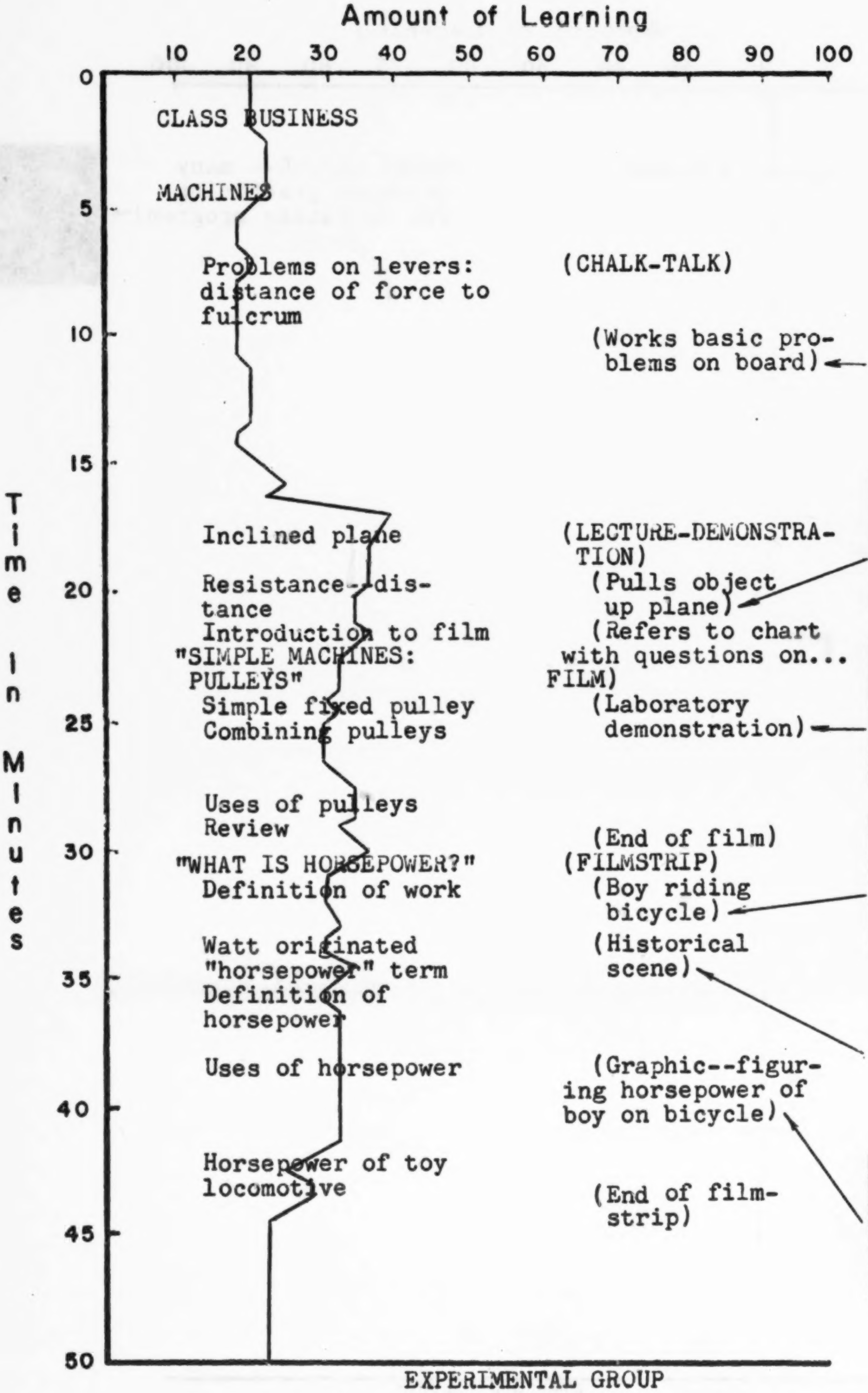
EXPERIMENTAL GROUP

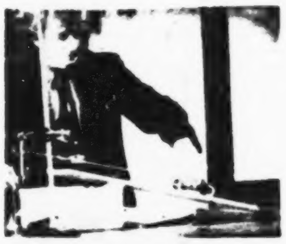
LEARNING PROFILE NUMBER 122

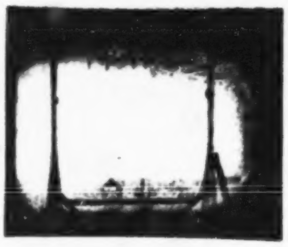


CONTROL GROUP

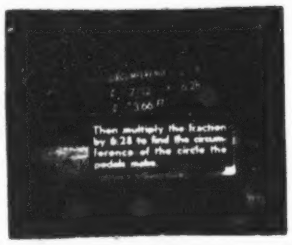
LEARNING PROFILE NUMBER 123







When you go uphill you work against gravity


Then multiply the fraction by 6.28 to find the circumference of the circle the pedals make.

EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 124

ANALYSIS OF LEARNING PROFILES 121 AND 122 AND 123 AND 124

Chalk-talk on levers in both groups brought approximately the same level of learning (C121, 3-8 and E122, 10-17). When the Experimental Group was given a film* on levers, learning reached 27 per cent (E122, 23-25) as compared to 16% at the highest point during chalk-talk on levers (C121, 11-12).

Pulleys were taken up in the Control Group by a filmstrip* which was a regular part of instruction with the average learning (C121, 12-41) slightly higher than the use of regular pulleys on a large frame, eight feet high (E122, 30-42).

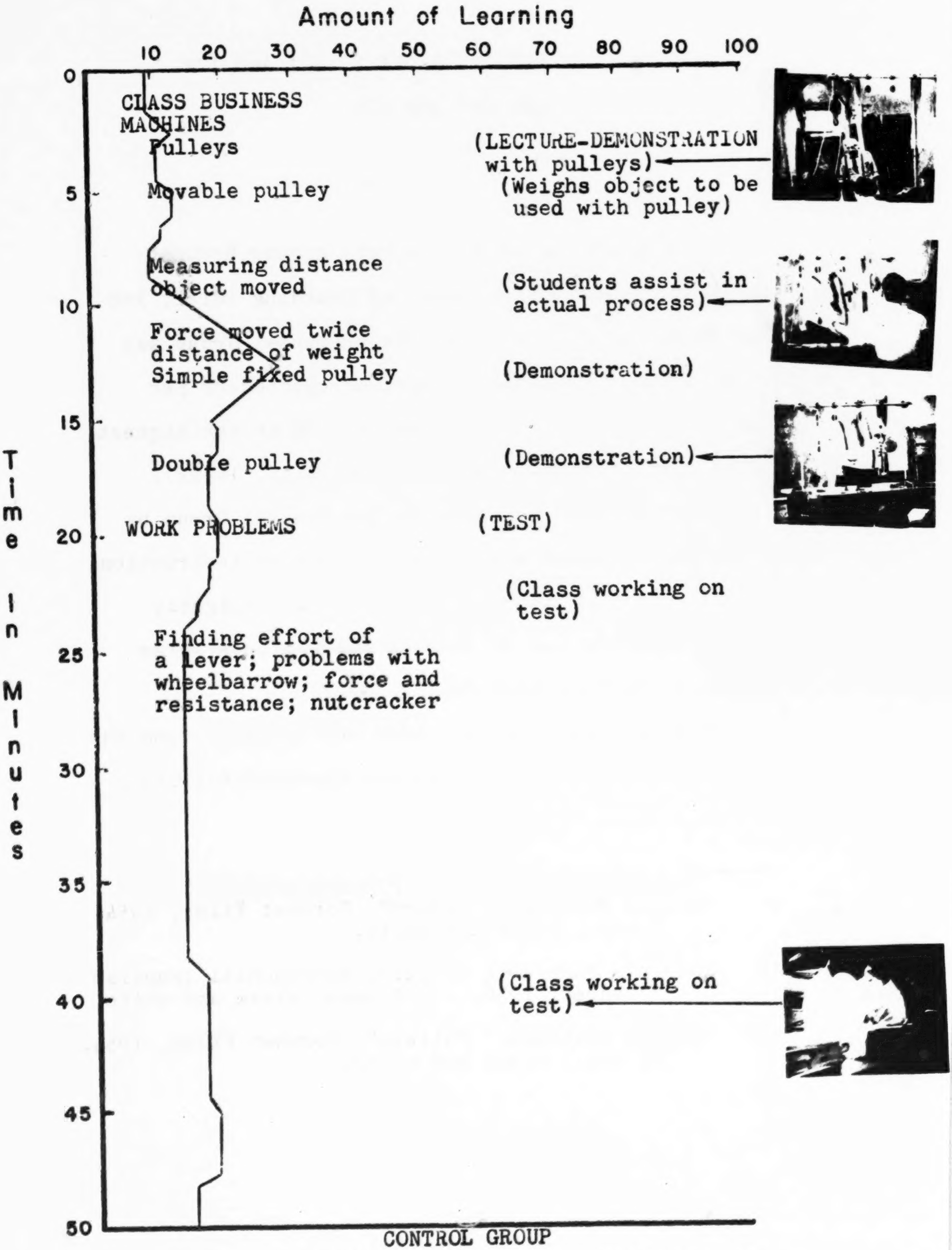
Greater learning than both the filmstrip and the actual pulleys resulted when the Experimental Group viewed a short film.***

---

* "Simple Machines: Levers", Coronet Films, 1954. 7 min., black and white.

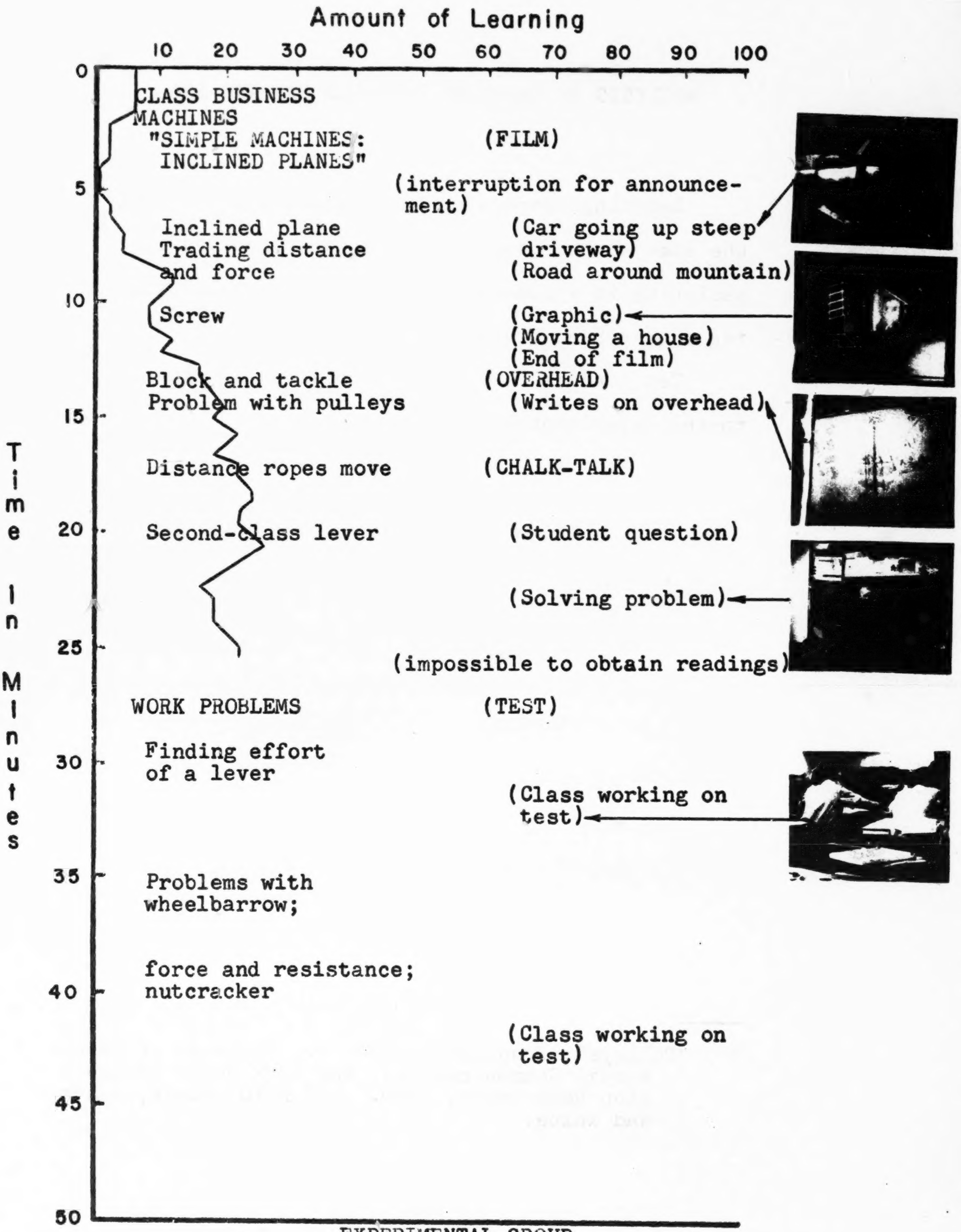
** "Pulleys Make Work Easier", McGraw-Hill (Popular Science), 1950. 52 frames, black and white.

*** "Simple Machines: Pulleys", Coronet Films, 1954. 6½ min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 125



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 126

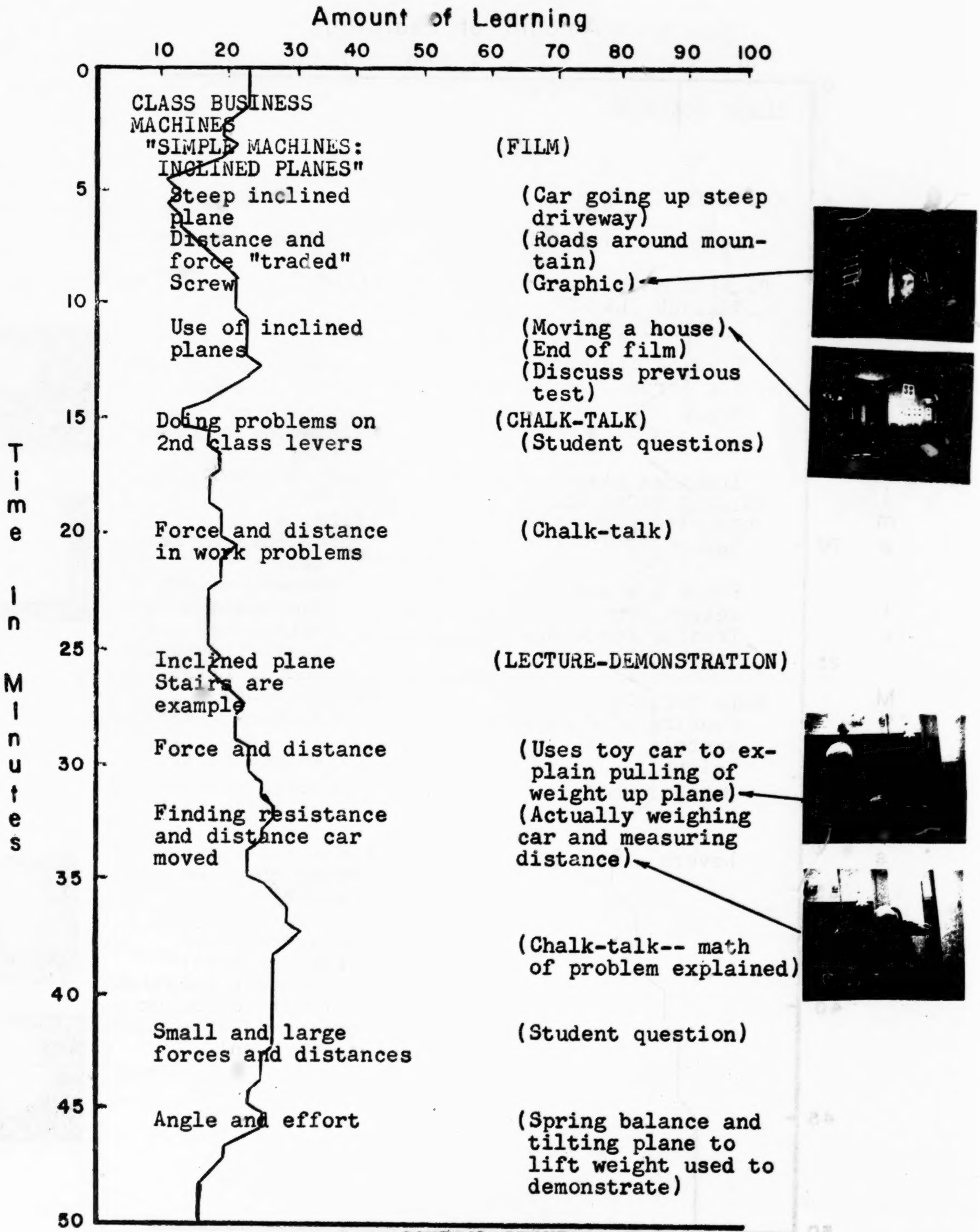
ANALYSIS OF LEARNING PROFILES 125 AND 126

Learning concerning pulleys was approximately the same whether some students were involved in assisting in a demonstration (C125, 3-19) or viewing an overhead transparency* (E126, 13-17).

Ten minutes less time on pulleys was given to the Experimental Group.

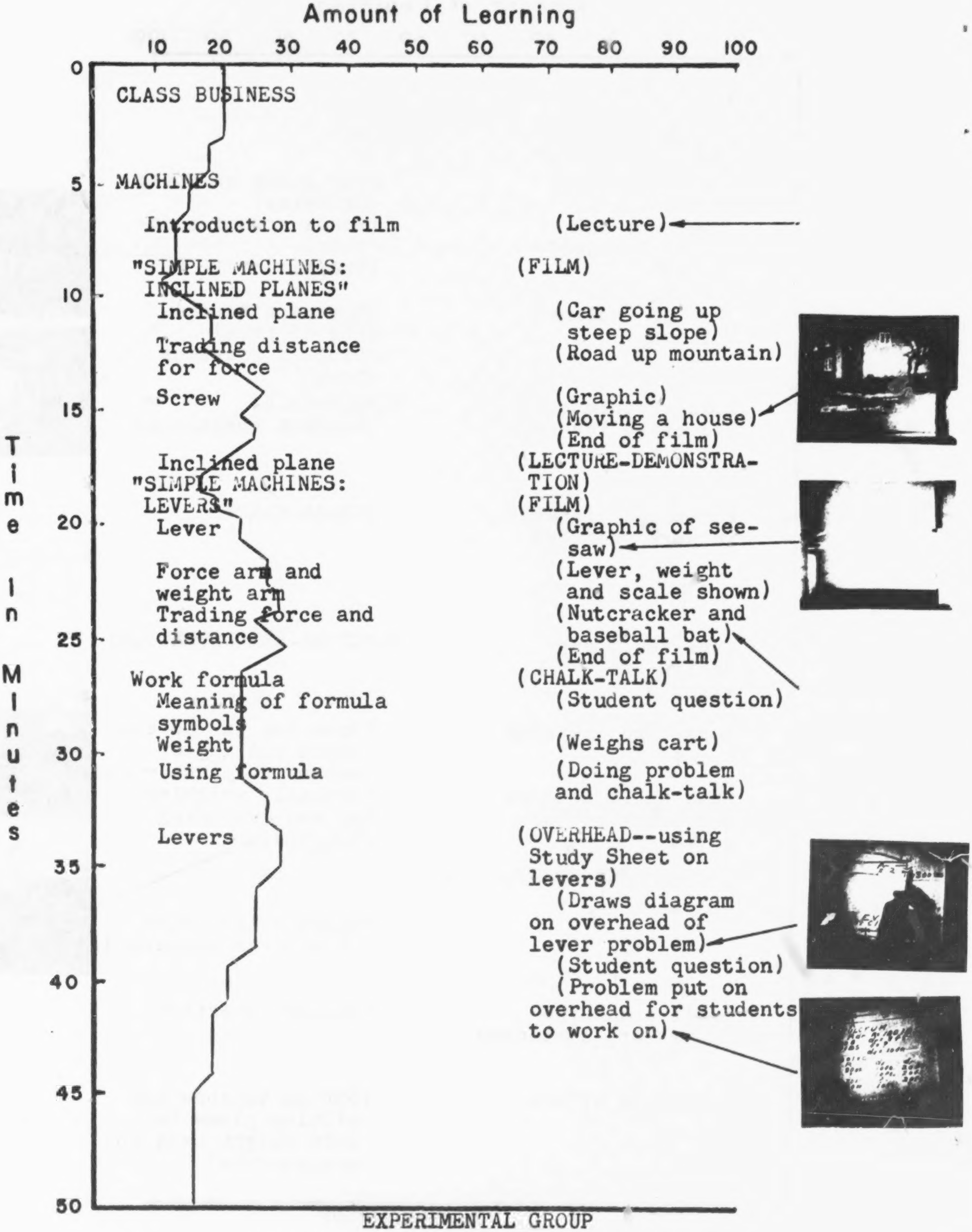
---

* "Pulleys", Transparency VI. i., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 127



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 128

ANALYSIS OF LEARNING PROFILES 127 AND 128

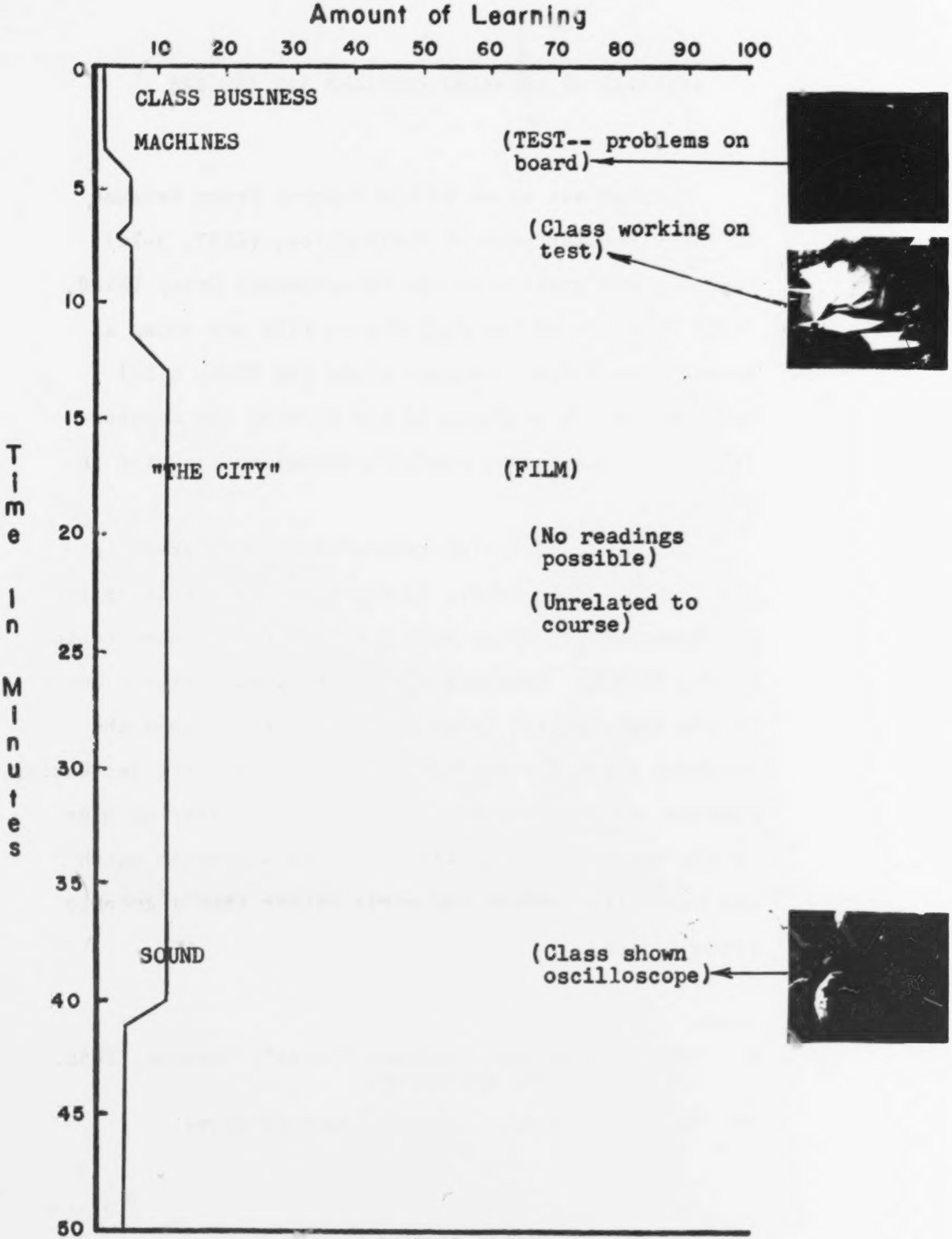
A film* was shown to the Control Group because it was a regular part of instruction, (C127, 3-12). Learning was greater in the Experimental Group (E128, 8-17) in spite of the fact that a film was shown a second time (shown previous class day E126, 4-12) because the introduction to the film by the teacher (E128, 7-8) indicated specific things to look for in the film.

Learning concerning levers was not as great in the Control Group (C127, 15-24) with chalk-talk as in the Experimental Group with a film** on the same topic (E128, 18-26). Learning also maintained a higher level in the Experimental Group when the teacher used the overhead projector (E128, 34-42) with learning decreasing, however, as the presentation went from a drawing made by the teacher with grease pencil to a problem which was basically numbers and words rather than a graphic presentation.

---

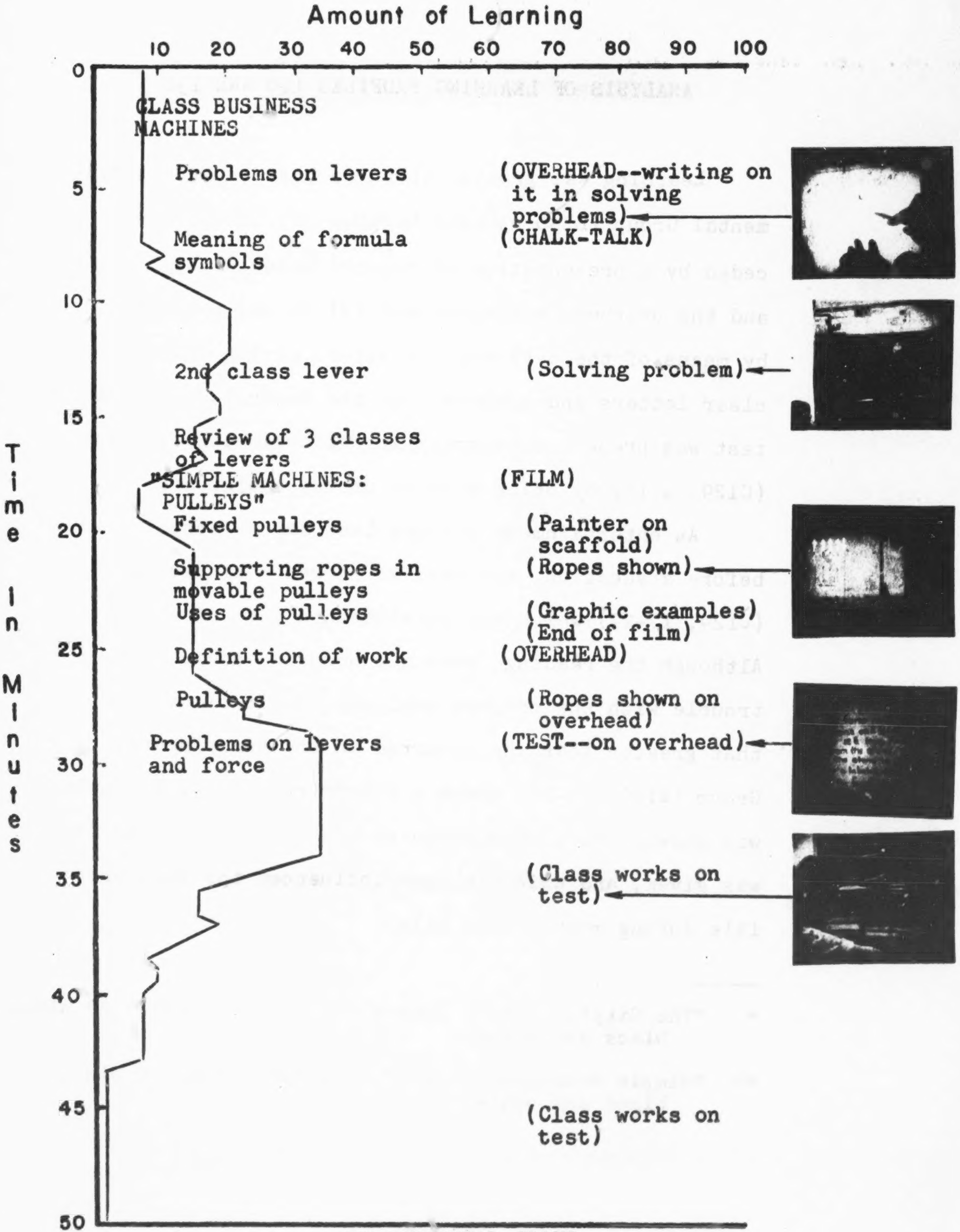
* "Simple Machines: Inclined Planes", Coronet, 1954. 6 min., black and white.

** "Simple Machines: Levers", same as above.



CONTROL GROUP

LEARNING PROFILE NUMBER 129



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 130

ANALYSIS OF LEARNING PROFILES 129 AND 130

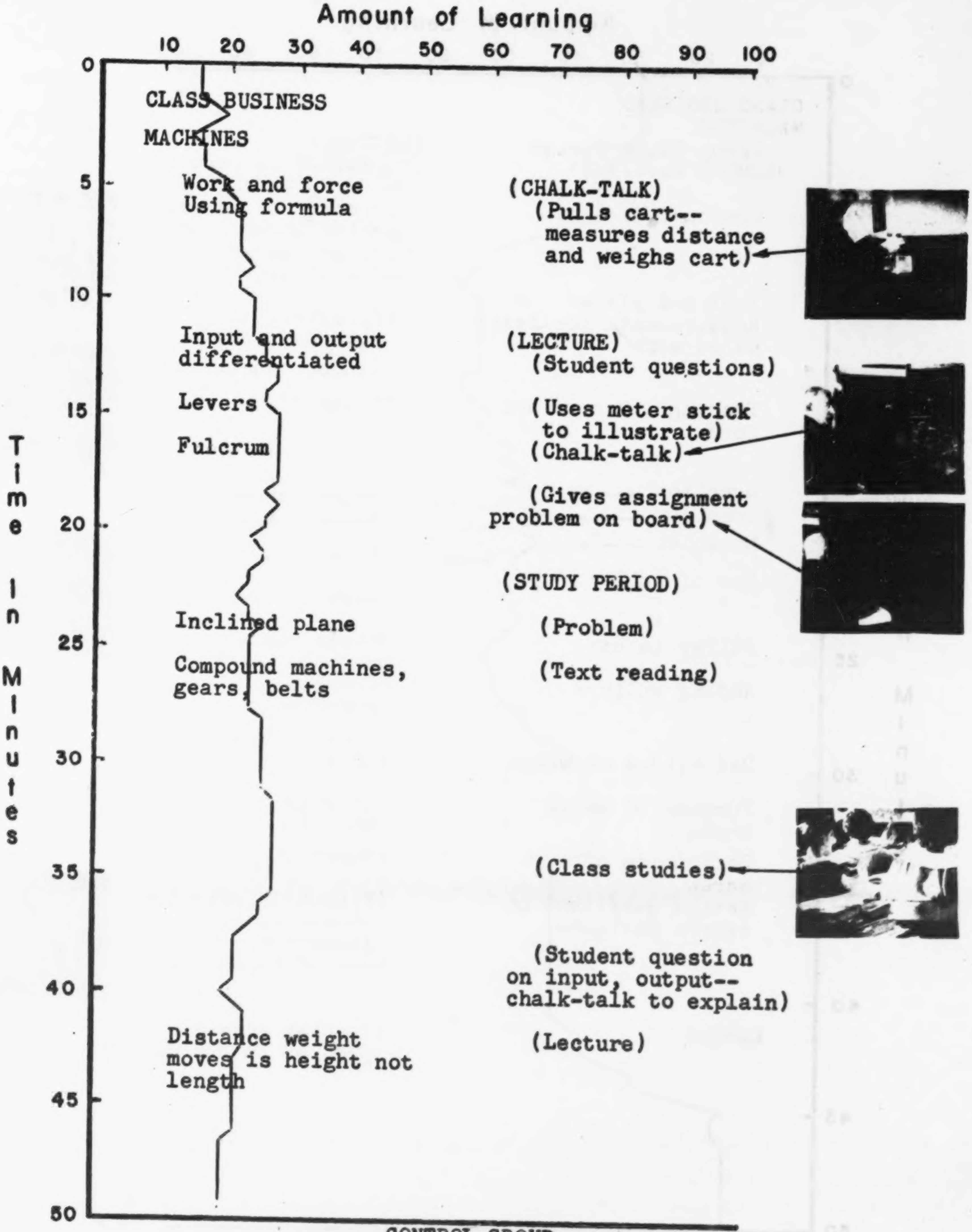
Learning was greater during a test in the Experimental Group (E130, 30-46) because (1) it was preceded by a presentation of related material by films and the overhead projector and (2) it was presented by means of the overhead projector, giving sharp, clear letters and numbers. In the Control Group the test was presented promptly at the beginning of class (C129, 4-16) by being written on the chalkboard.

As entertainment for the last day of school before a vacation, the teacher showed a kinescope* (C129, 17-27) which was unrelated to the course. Although the readings were not accurate because of trouble with the program analyzer, indications were that greater learning occurred in the Experimental Group (E130, 18-24) where a film** related to the unit was shown. No introduction or preparation for the film was given, and this may have influenced the flat profile during most of the film.

---

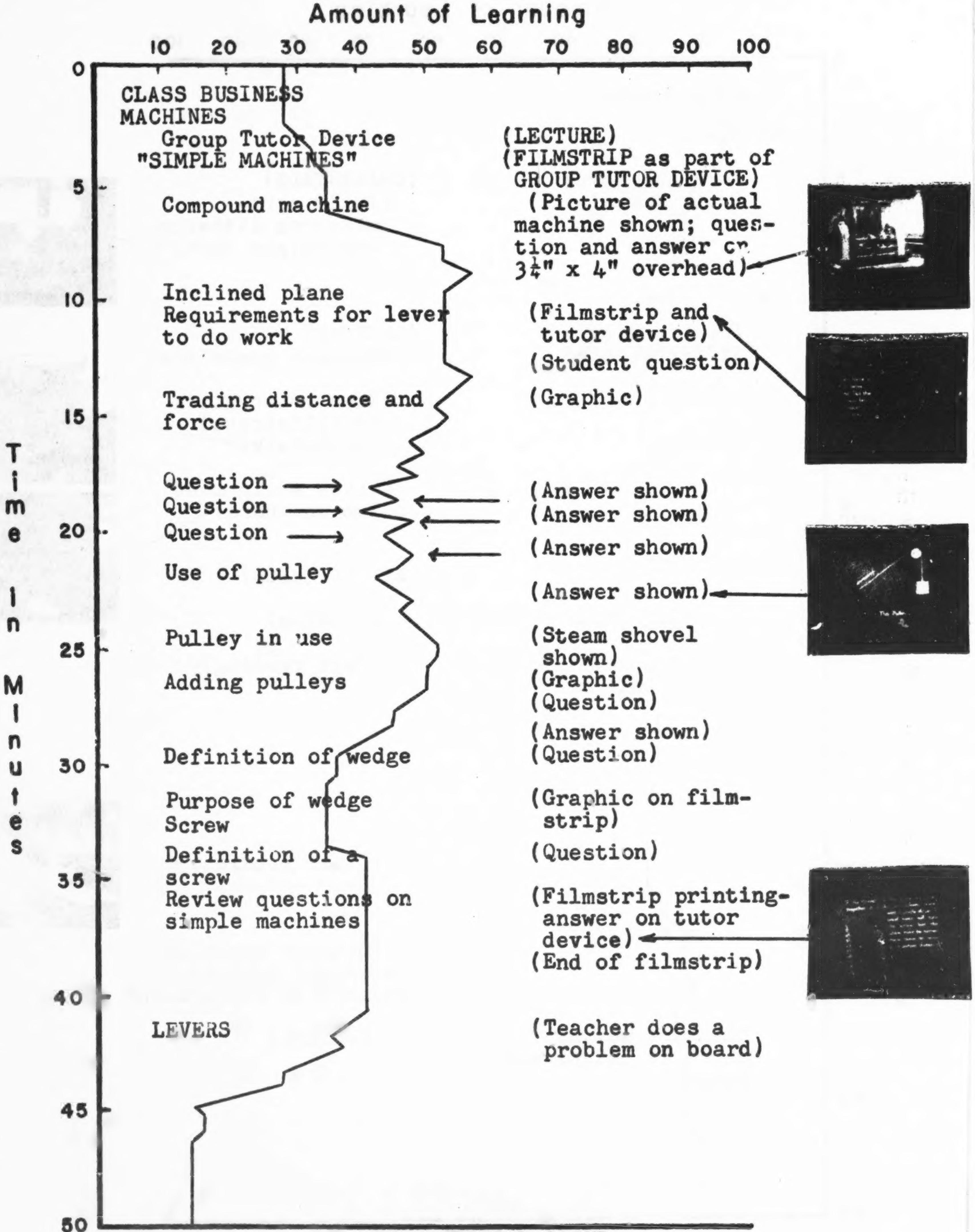
* "The City", C.B.S. Camera III series, 1953. 20 min., black and white.

** "Simple Machines:Pulleys", Coronet, 1954. 6 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 131



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 132

ANALYSIS OF LEARNING PROFILES 131 AND 132

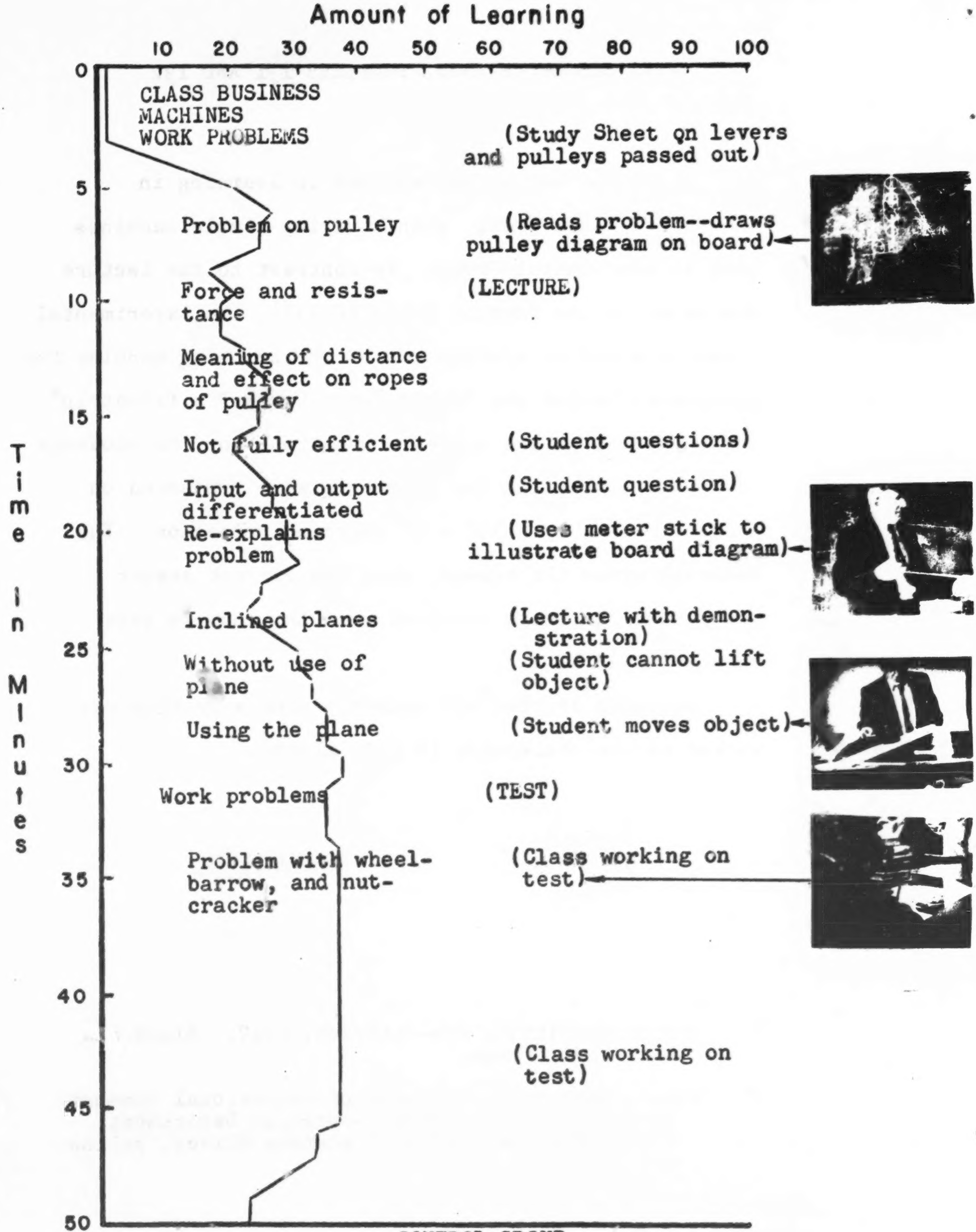
A greater variation resulted in learning in the Experimental Group when studying simple machines than in the Control Group. In contrast to the lecture and study in the Control Group (C 131), the Experimental Group received an application of the teaching machine for group use. Called the "Group Tutor Device" a filmstrip* was projected on one screen. Questions for the students to answer concerning the filmstrip were projected on another screen by a 3¼" x 4" overhead projector. The Students wrote the answer, then the correct answer was shown. Leraning resulted when the answers were shown (E 132, 18-22).

Learning dropped off promptly when a problem was worked on the chalkboard (E 132, 41-45).

---

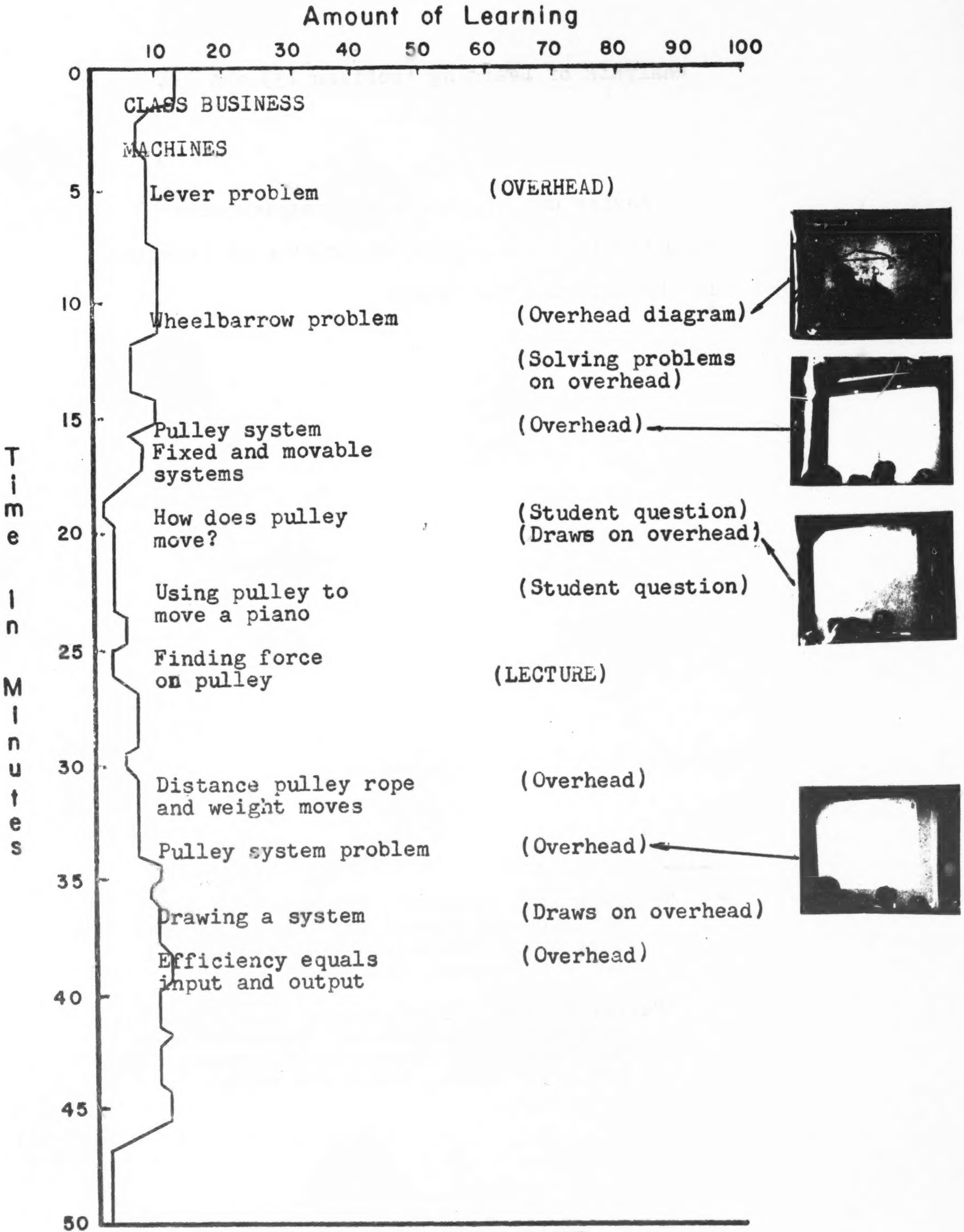
* "Simple Machines", Row-Peterson, 1947. Black and white, 75 frames.

** "Simple Machines", Division of Educational Communications, New York State Education Department, 1960. Thirteen 3¼" x 4" acetate slides, yellow and red.



CONTROL GROUP

LEARNING PROFILE NUMBER 133



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 134

Analysis of Learning Profiles 133 and 134

Review use of overhead transparencies* resulted in a low, unvaried profile of learning in the Experimental Group.

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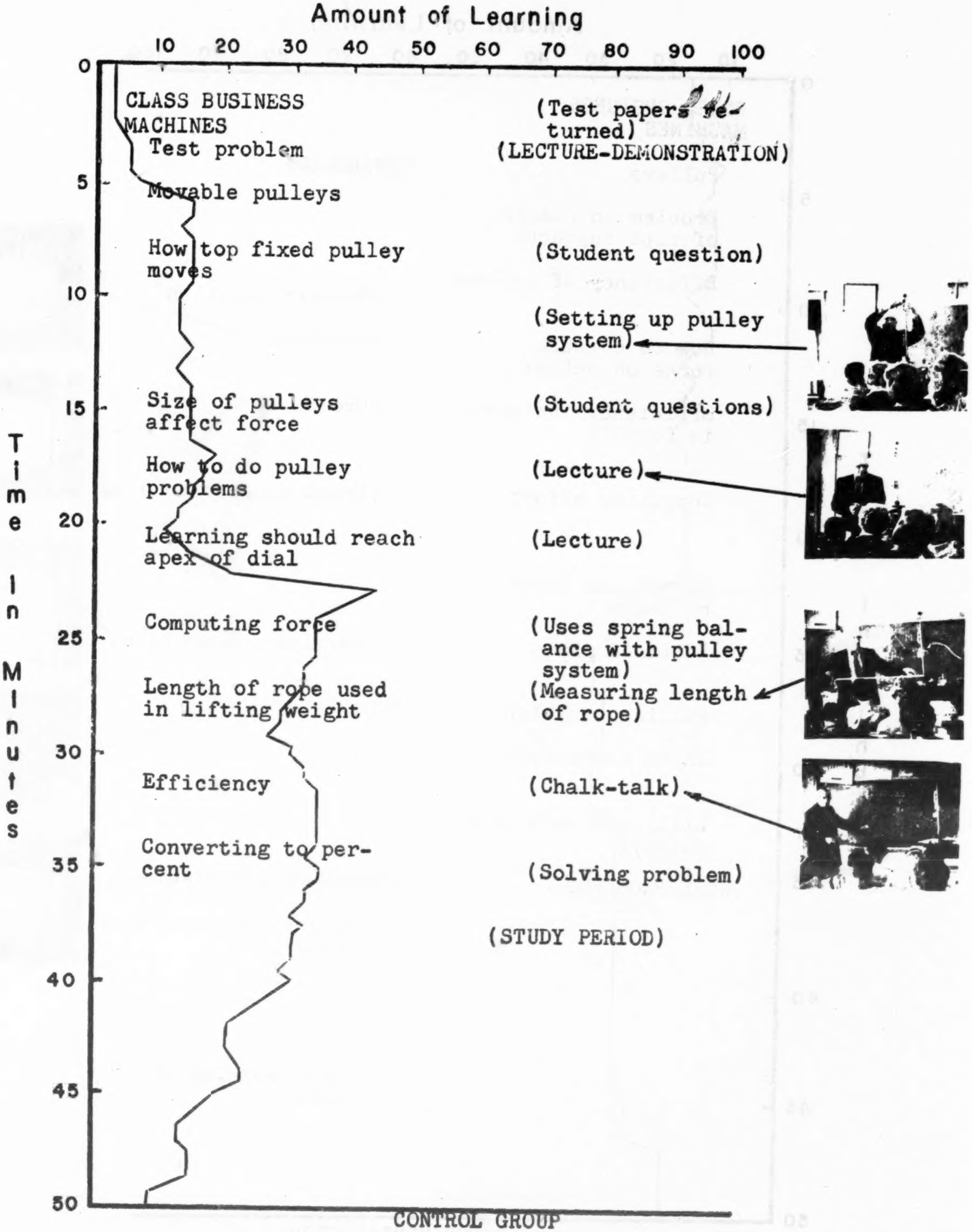
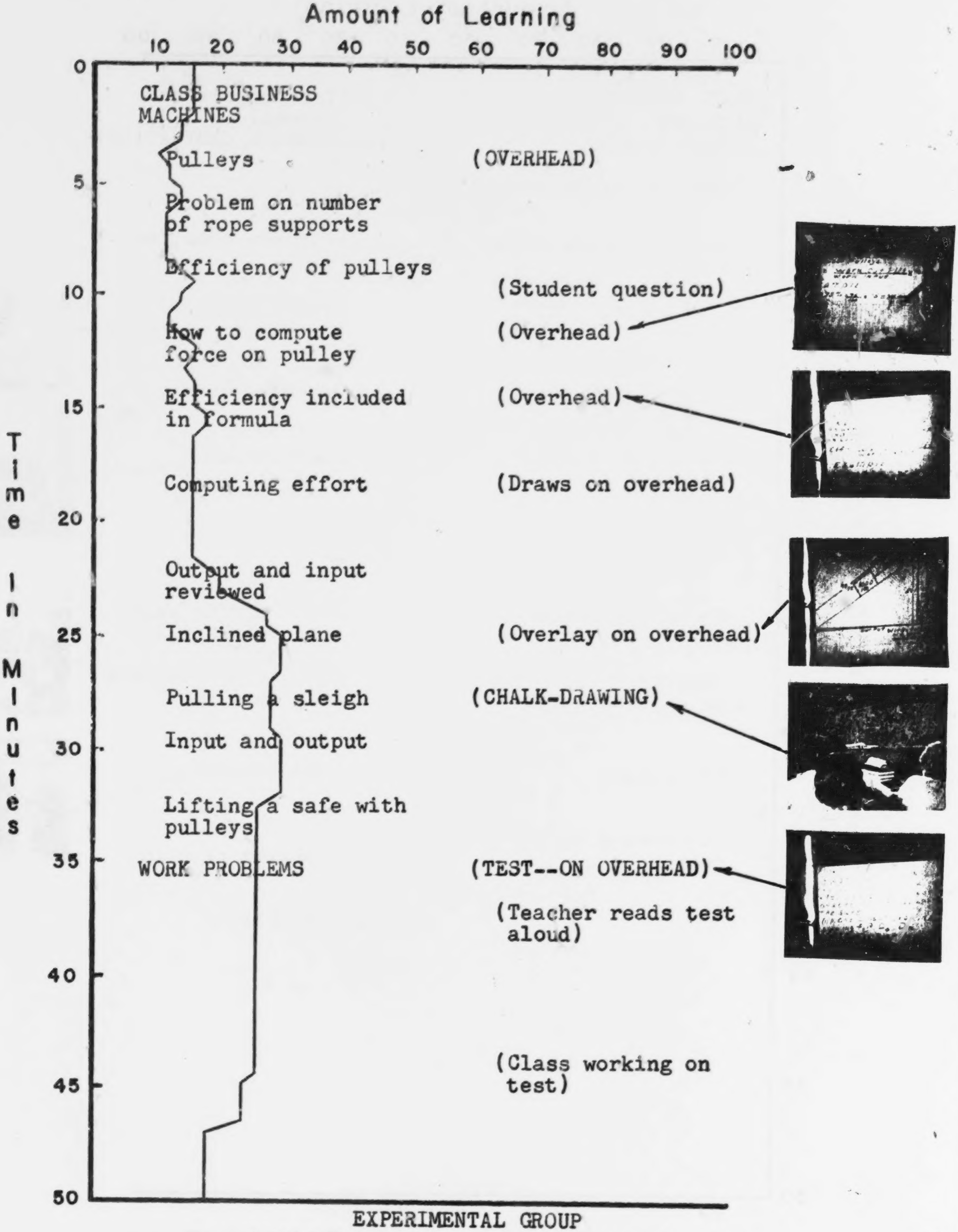
* "Pulleys with Weights", Transparency VI. i., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.

"Pulley System", Transparency VI. Y. 1 & 2., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 135



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 136

Analysis of Learning Profiles 135 and 136

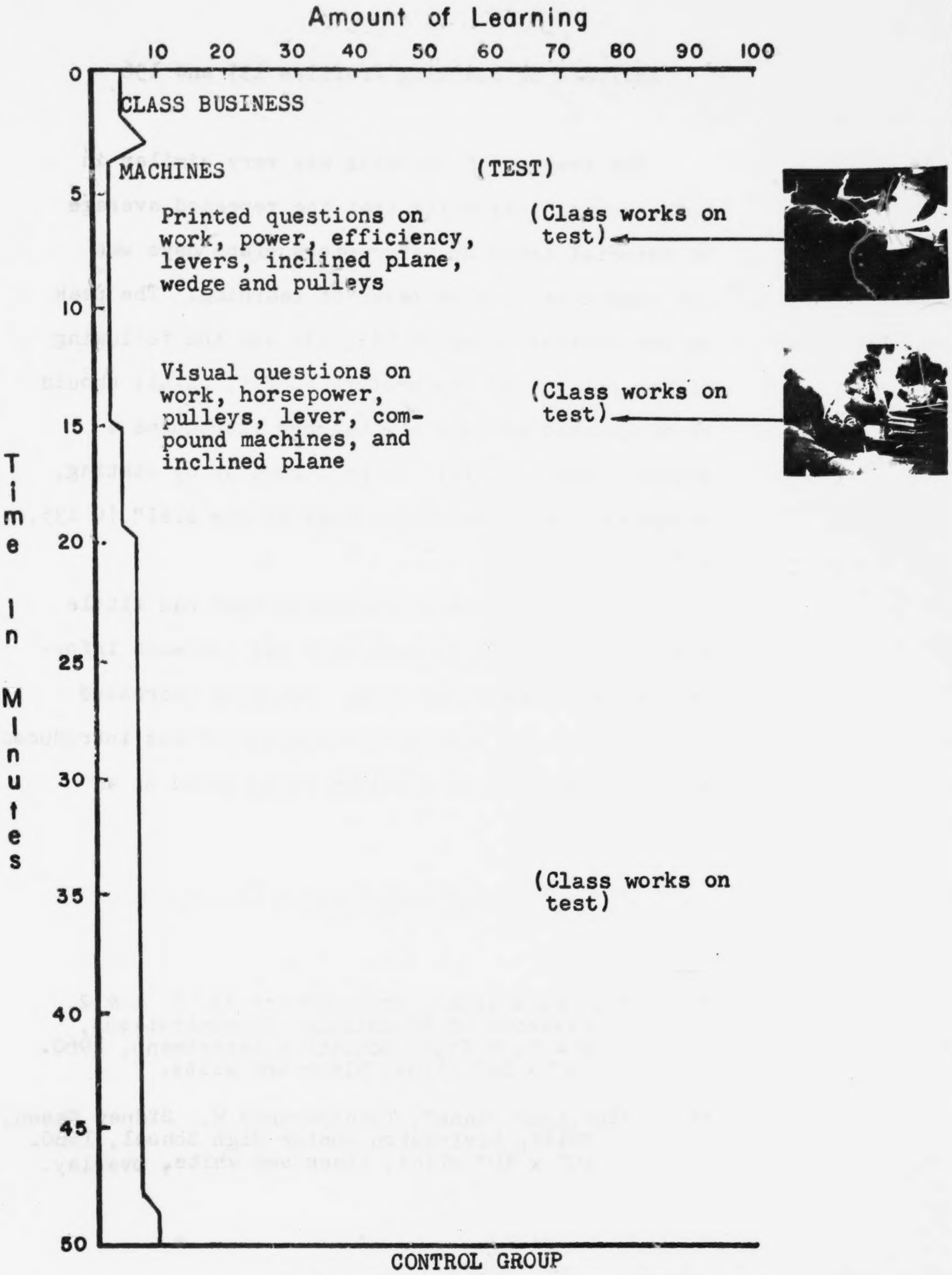
The average of learning was very similar in both groups, indicating that the repeated average of material taken up in previous class days was not conducive to high peaks of learning. The peak in the Control Group (C 135, 23) and the following higher portion of the profile (C 135, 24-41) should be discounted because the teacher introduced a special plea for dials to be turned up by stating, "learning should reach the apex of the dial" (C 135, 23).

A set of overhead transparencies* had little effect on learning because they had too much information--and in written form. Learning increased somewhat when an overlay transparency** was introduced showing a diagram of a weight being moved up an inclined plane.

---

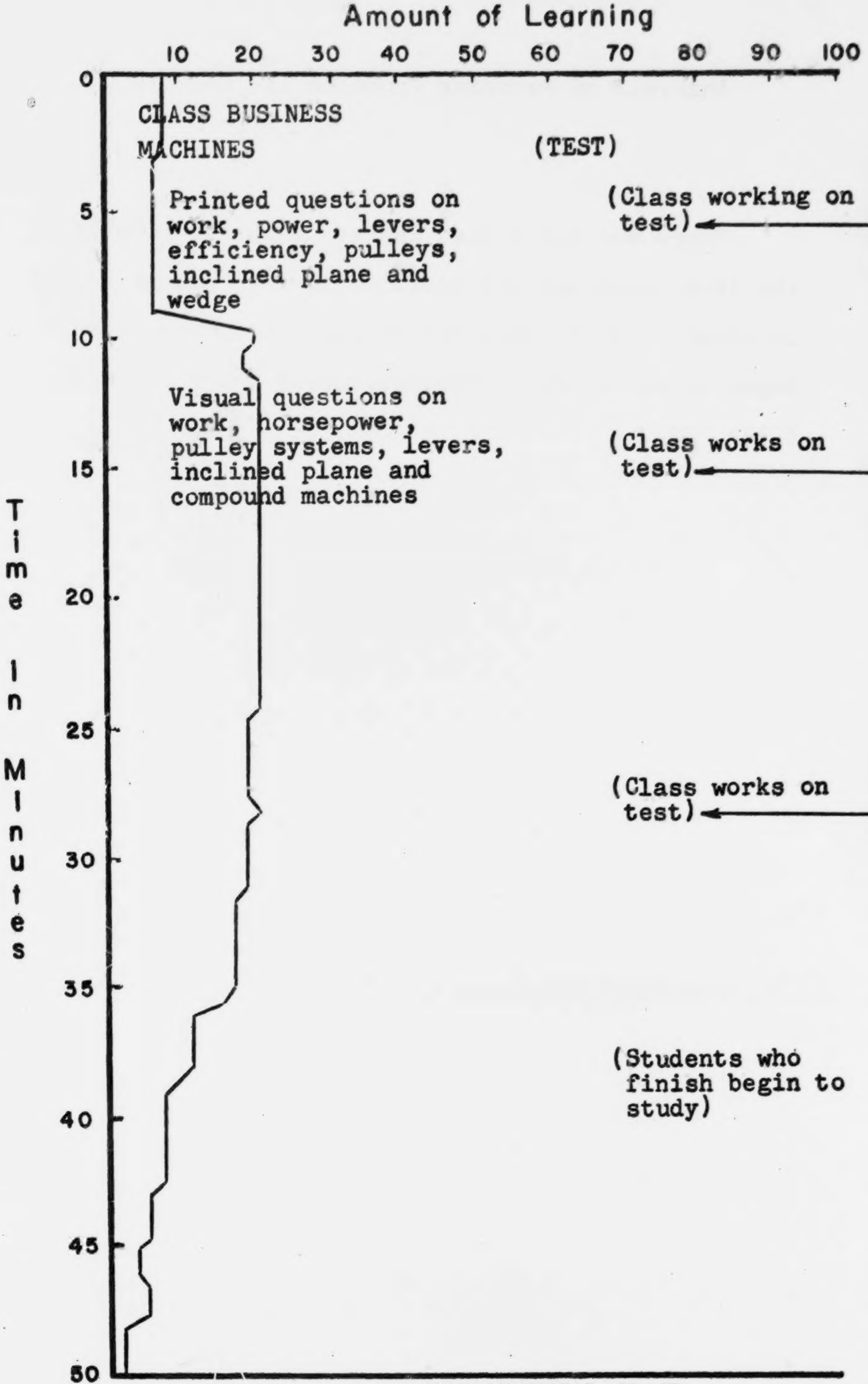
* "Pulley System", Transparency VI. Y. 1 & 2, Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, black and white.

** "Inclined Plane", Transparency M, Sidney Mason, Philip Livingston Junior High School, 1960. 10" x 10" slide, black and white, overlay.



CONTROL GROUP

LEARNING PROFILE NUMBER 137



CLASS BUSINESS

MACHINES

(TEST)

Printed questions on work, power, levers, efficiency, pulleys, inclined plane and wedge

Visual questions on work, horsepower, pulley systems, levers, inclined plane and compound machines

(Class working on test)

(Class works on test)

(Class works on test)

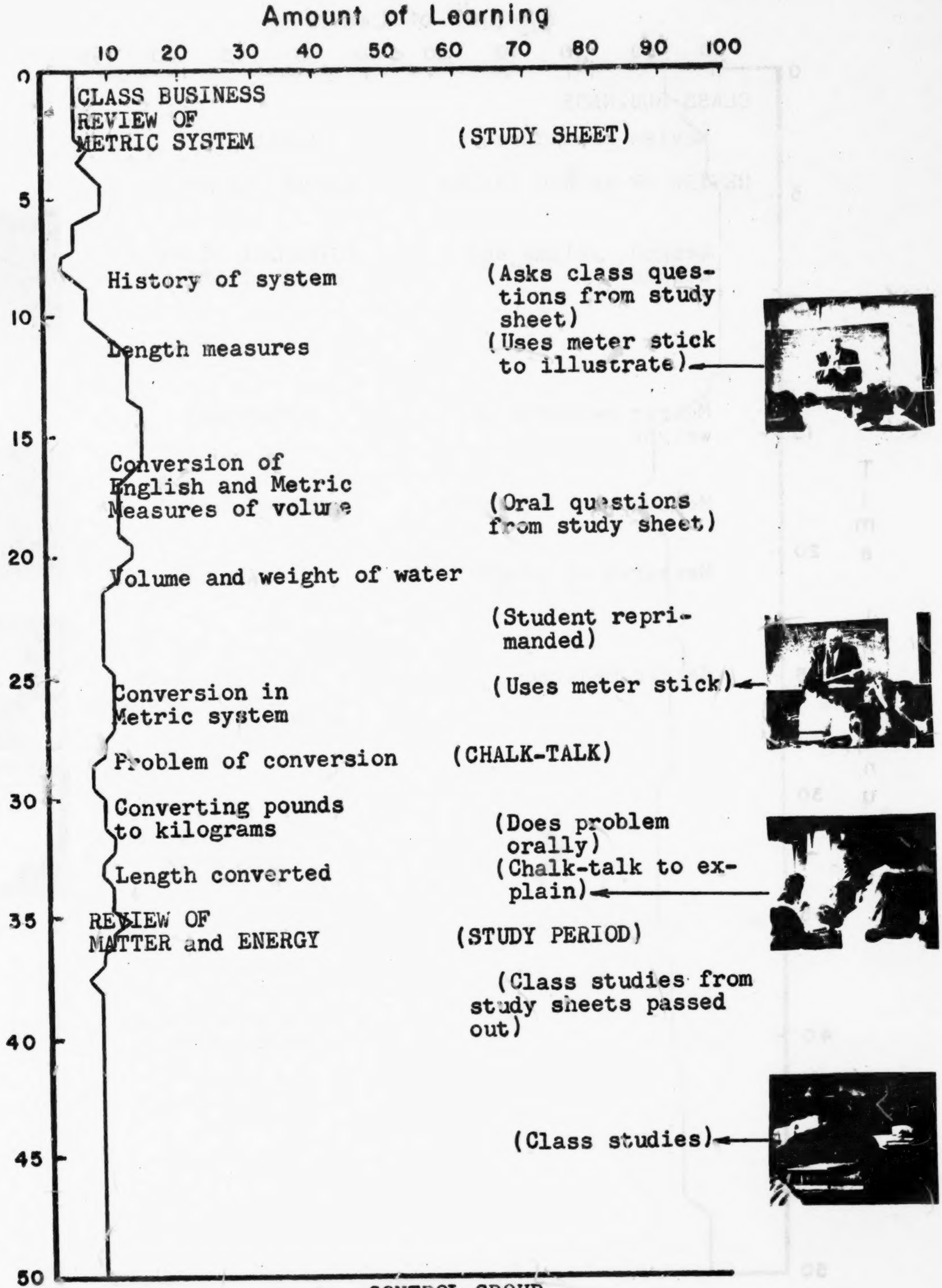
(Students who finish begin to study)

EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 138

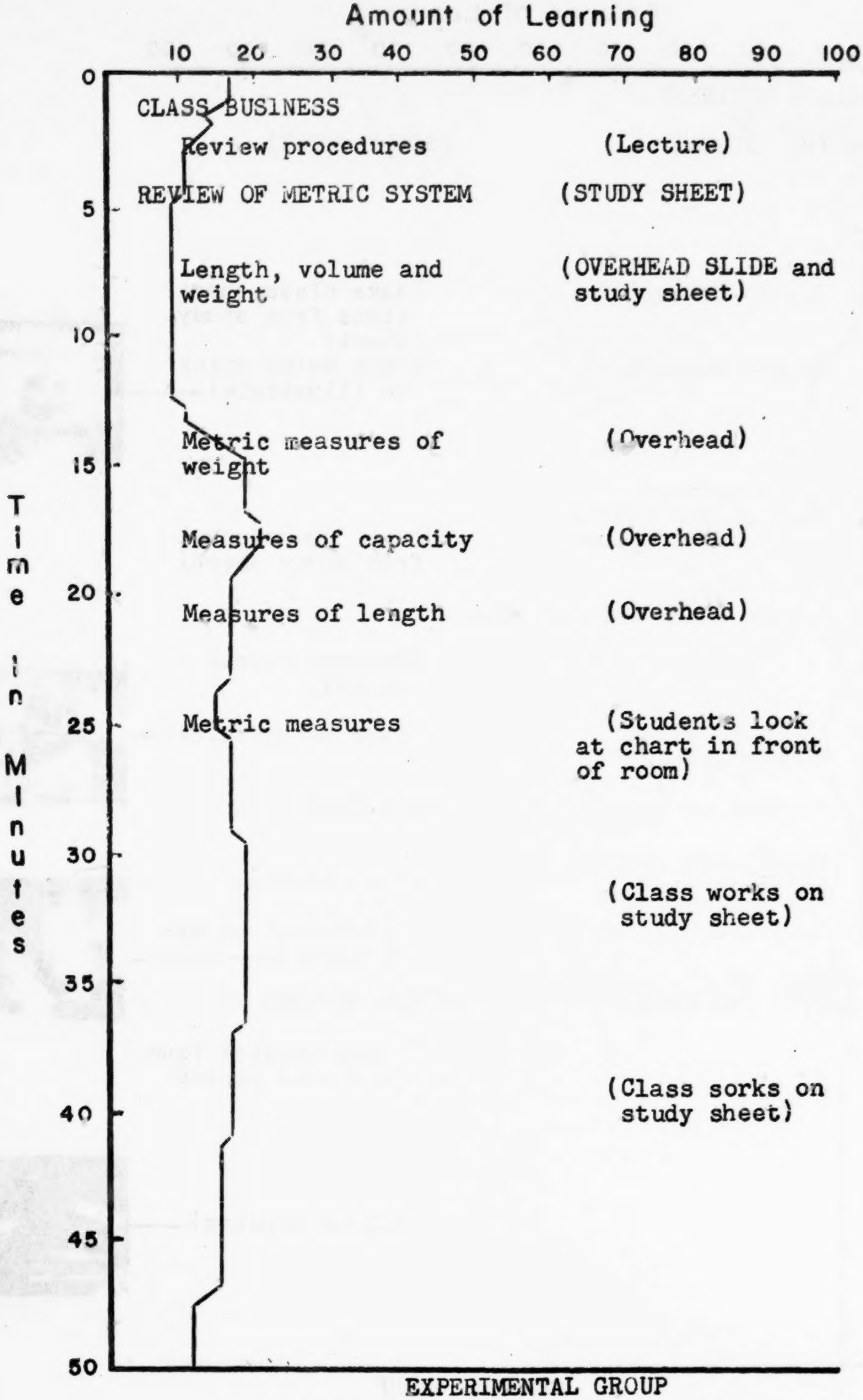
Analysis of Learning Profiles 137 and 138

There was not a high degree of learning during the test, although the profiles in both groups began to climb slightly when the "visual questions" were begun by the students (approximately C 137, 15 and E 138, 12).



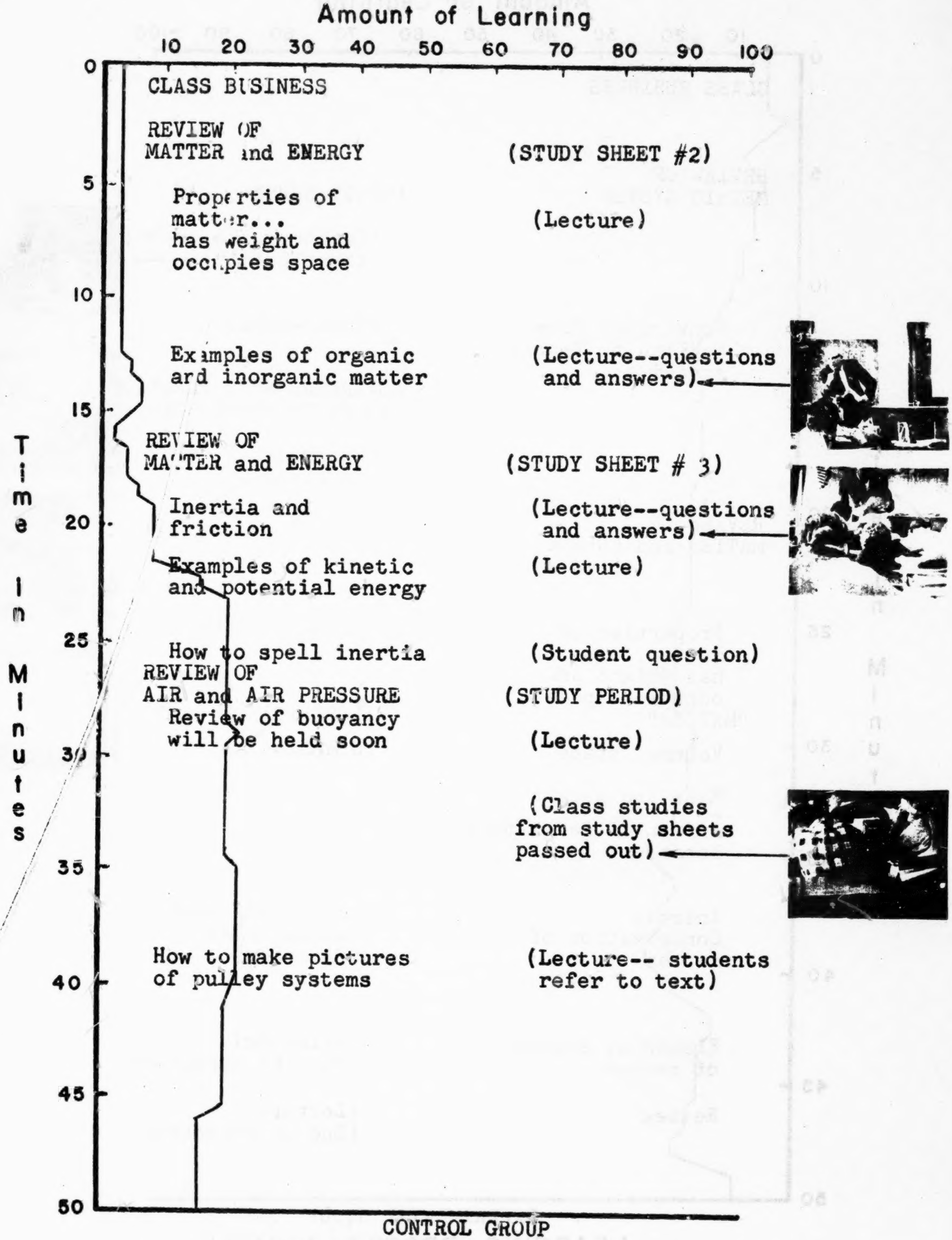
CONTROL GROUP

LEARNING PROFILE NUMBER 139



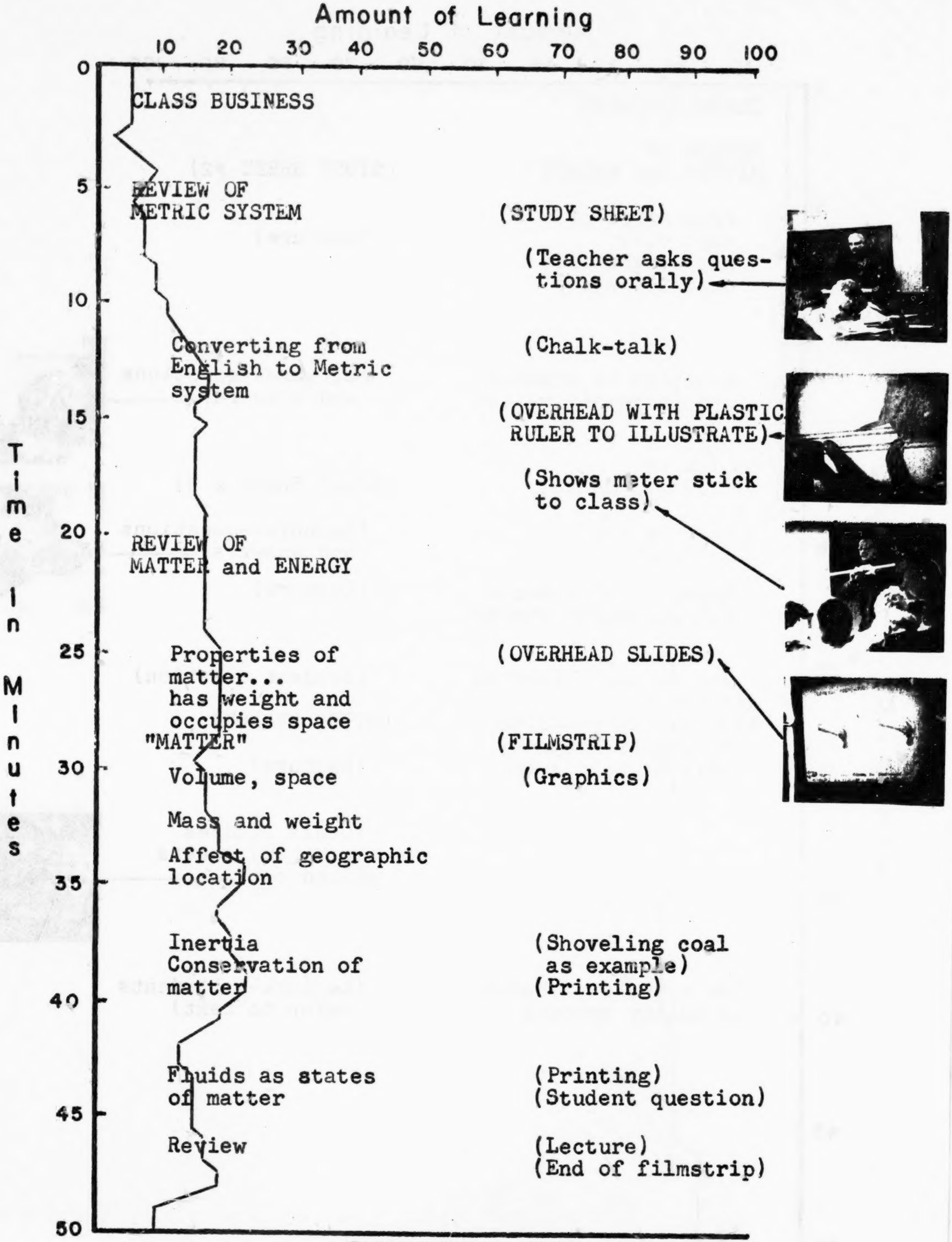
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 140



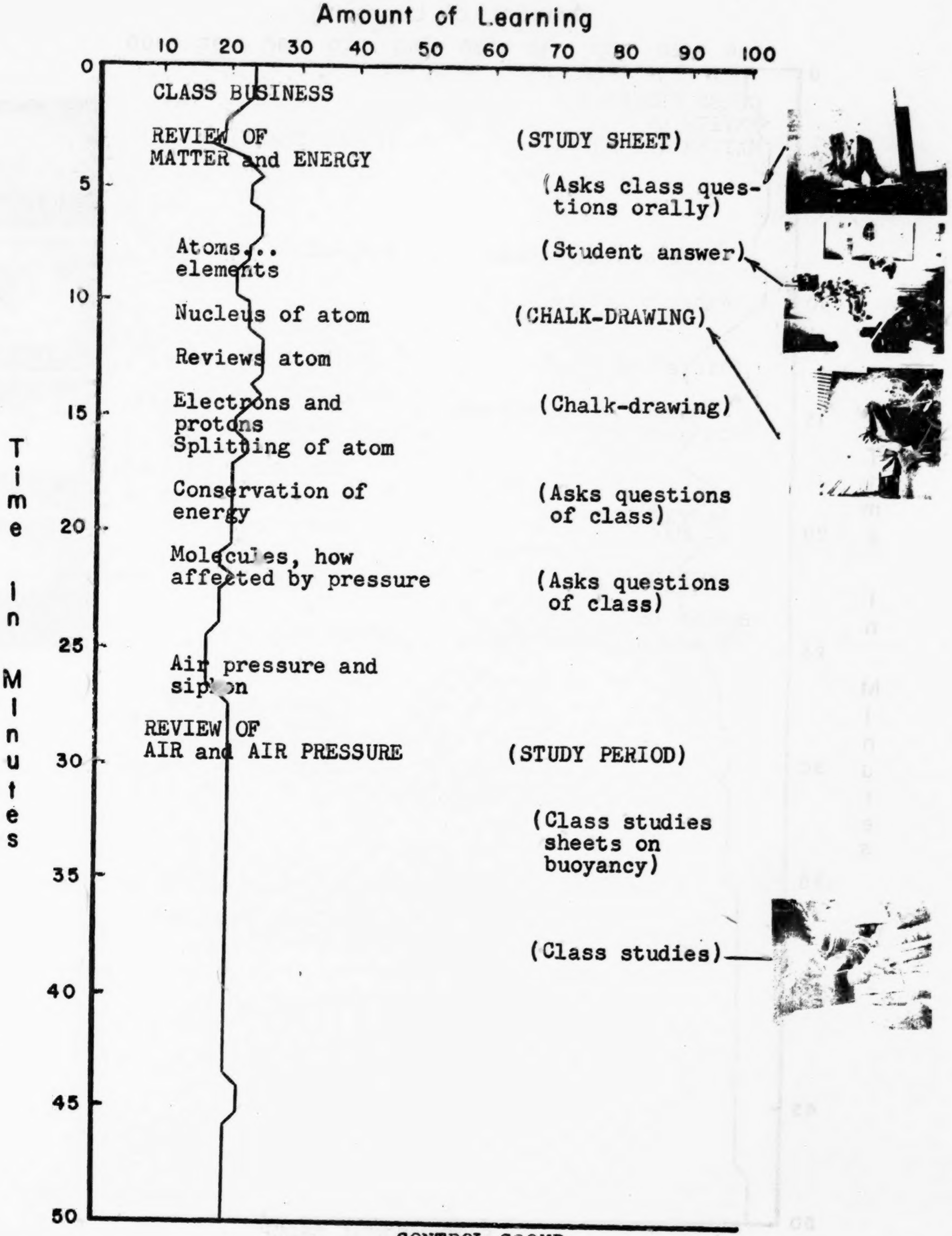
CONTROL GROUP

LEARNING PROFILE NUMBER 141



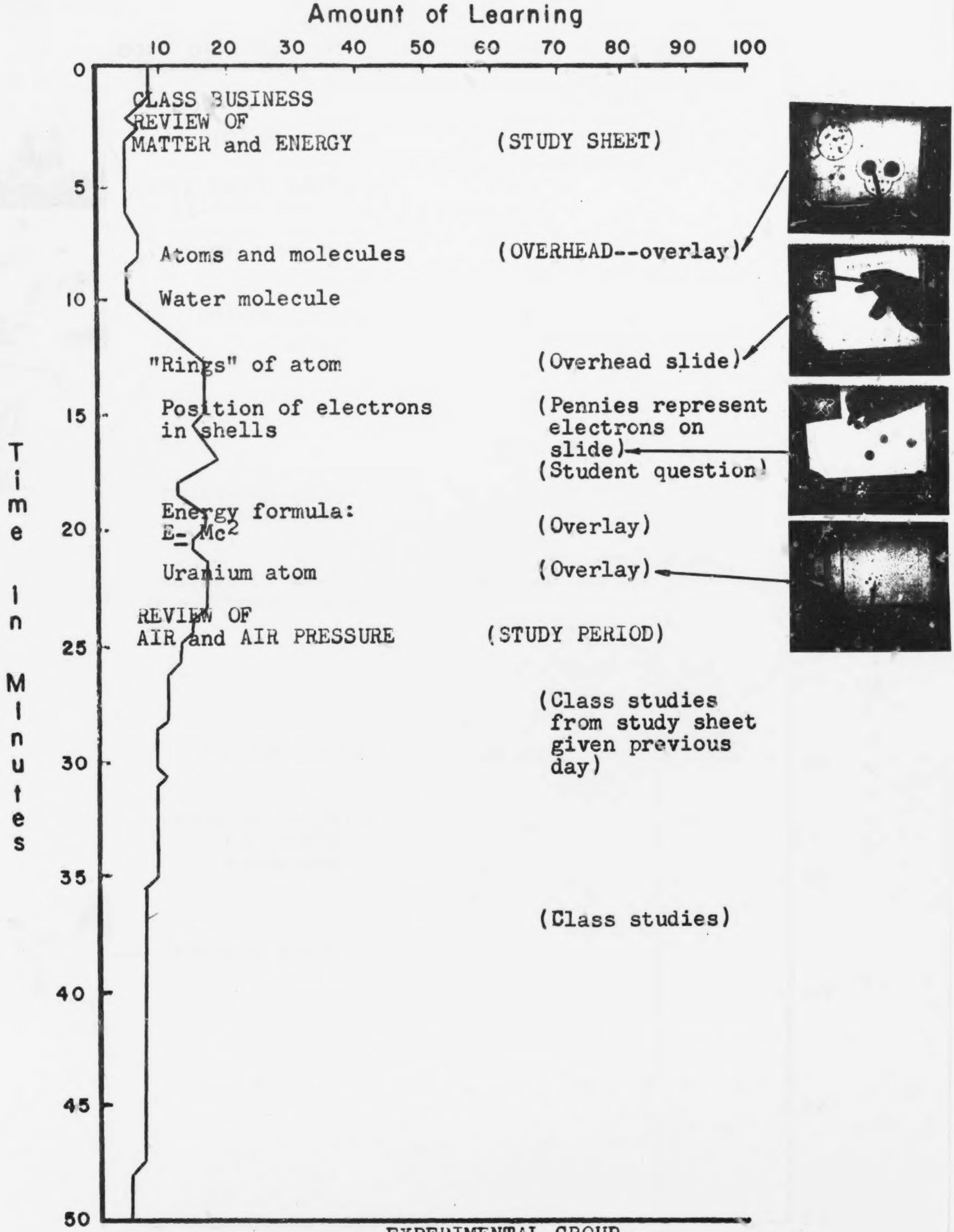
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 142



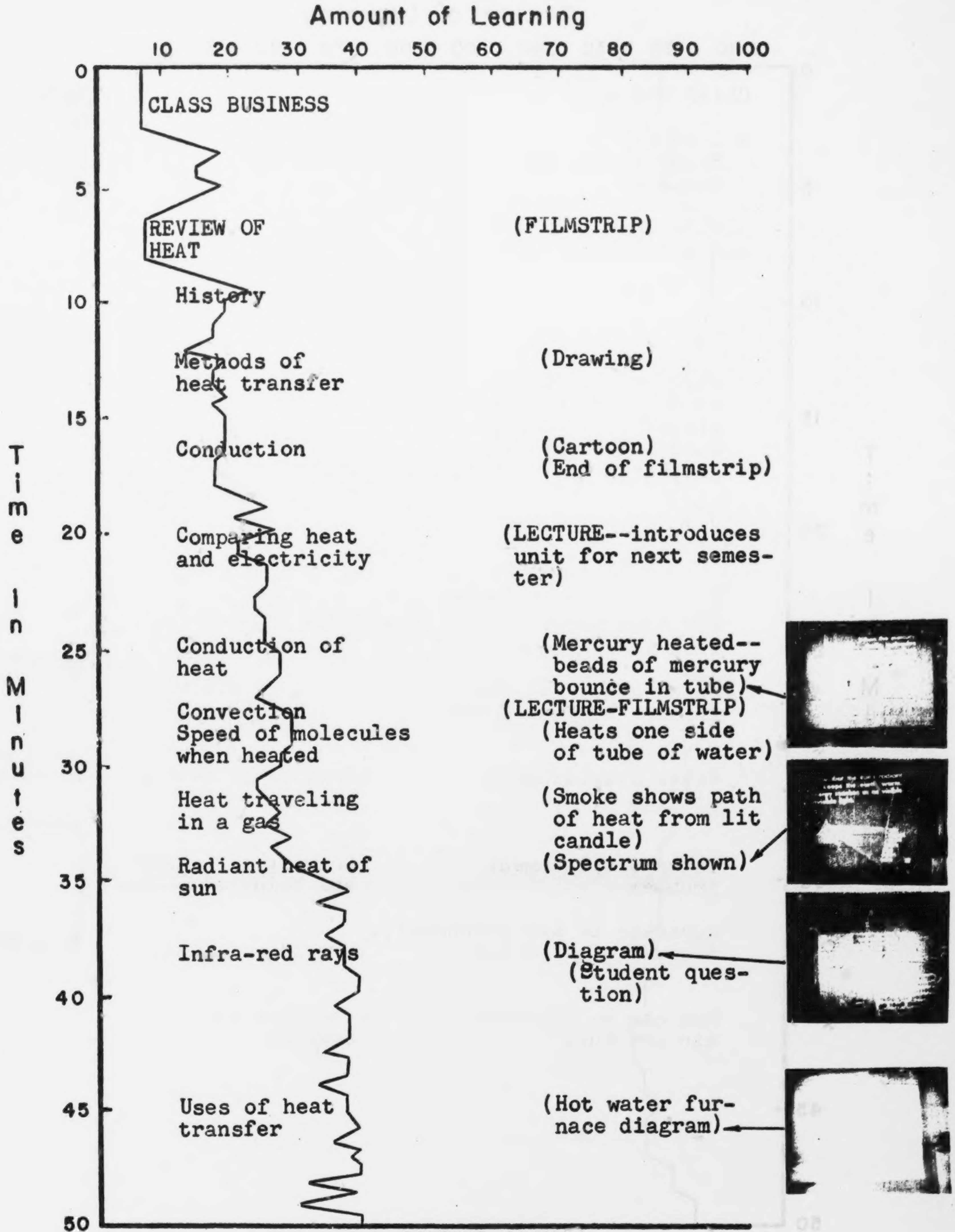
CONTROL GROUP

LEARNING PROFILE NUMBER 143



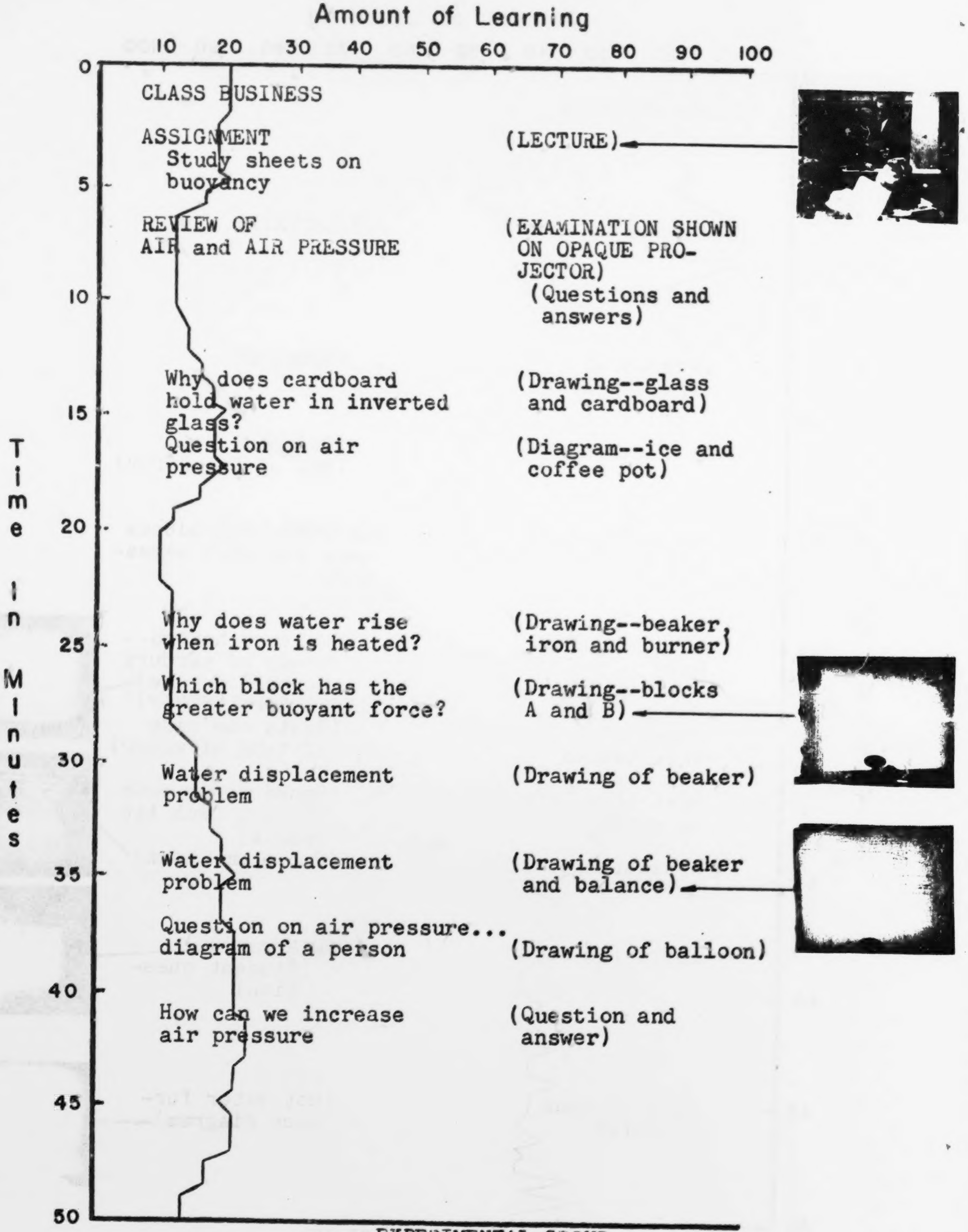
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 144



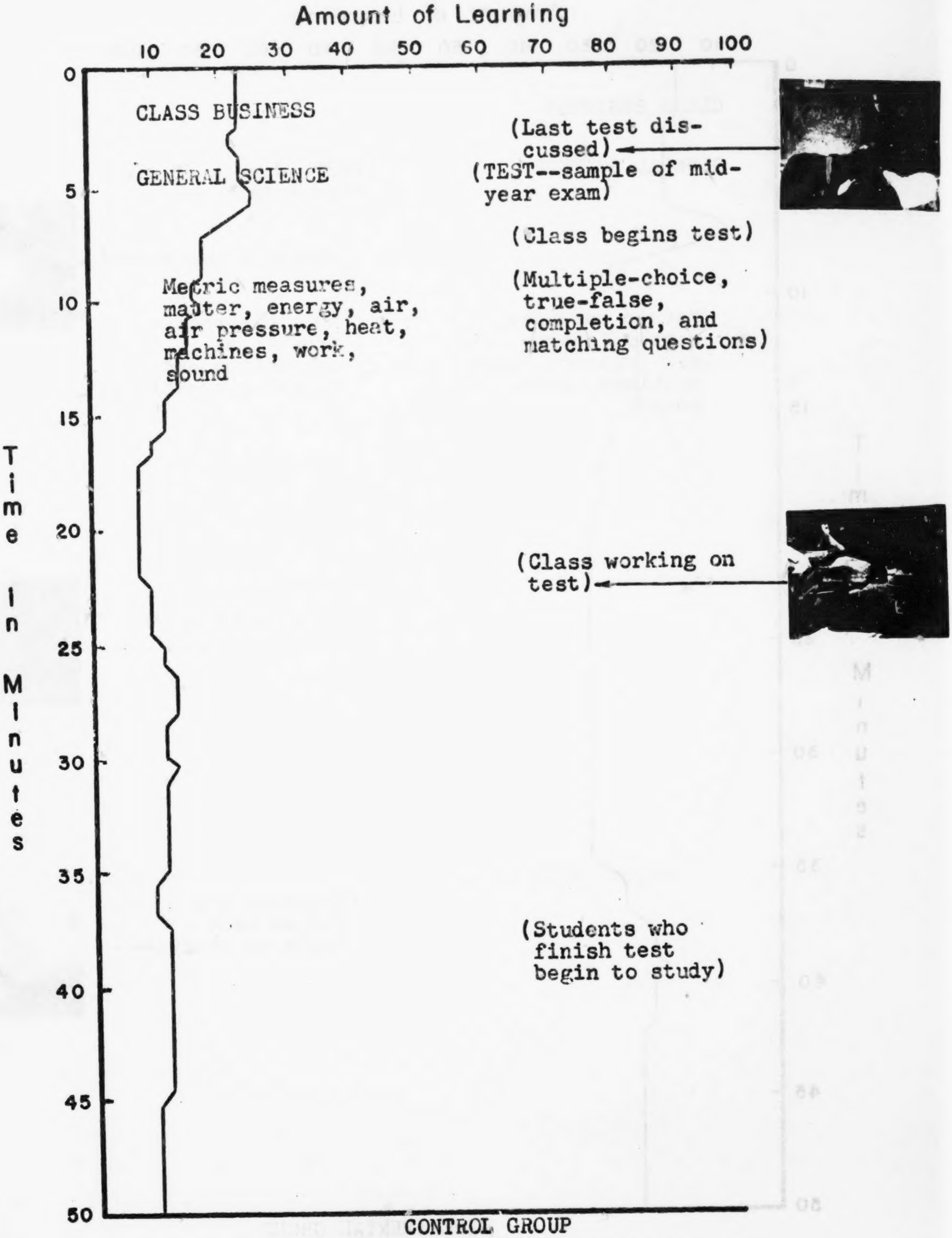
CONTROL GROUP

LEARNING PROFILE NUMBER 145



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 146



CLASS BUSINESS

GENERAL SCIENCE

Metric measures, matter, energy, air, air pressure, heat, machines, work, sound

(Last test discussed)

(TEST--sample of mid-year exam)

(Class begins test)

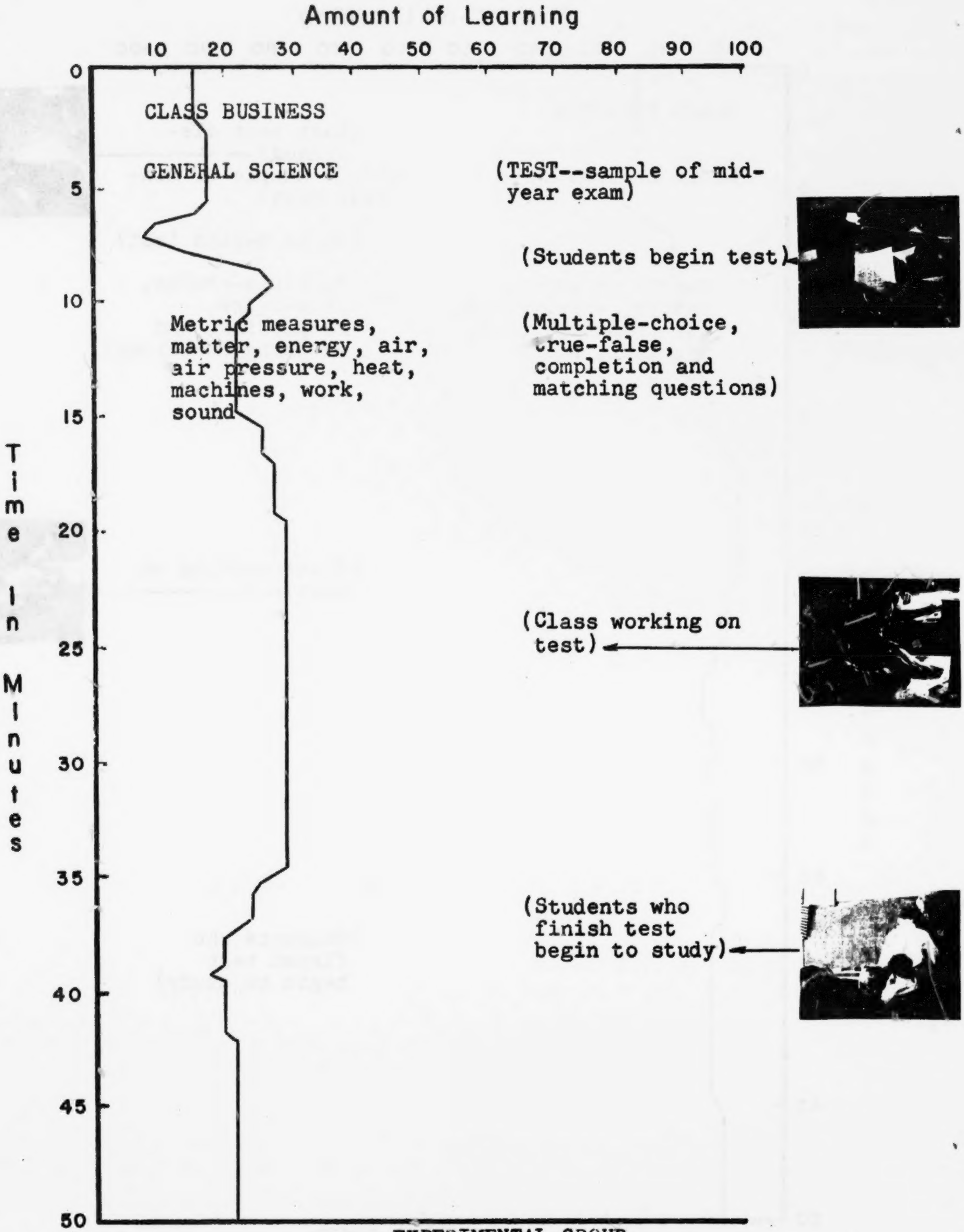
(Multiple-choice, true-false, completion, and matching questions)

(Class working on test)

(Students who finish test begin to study)

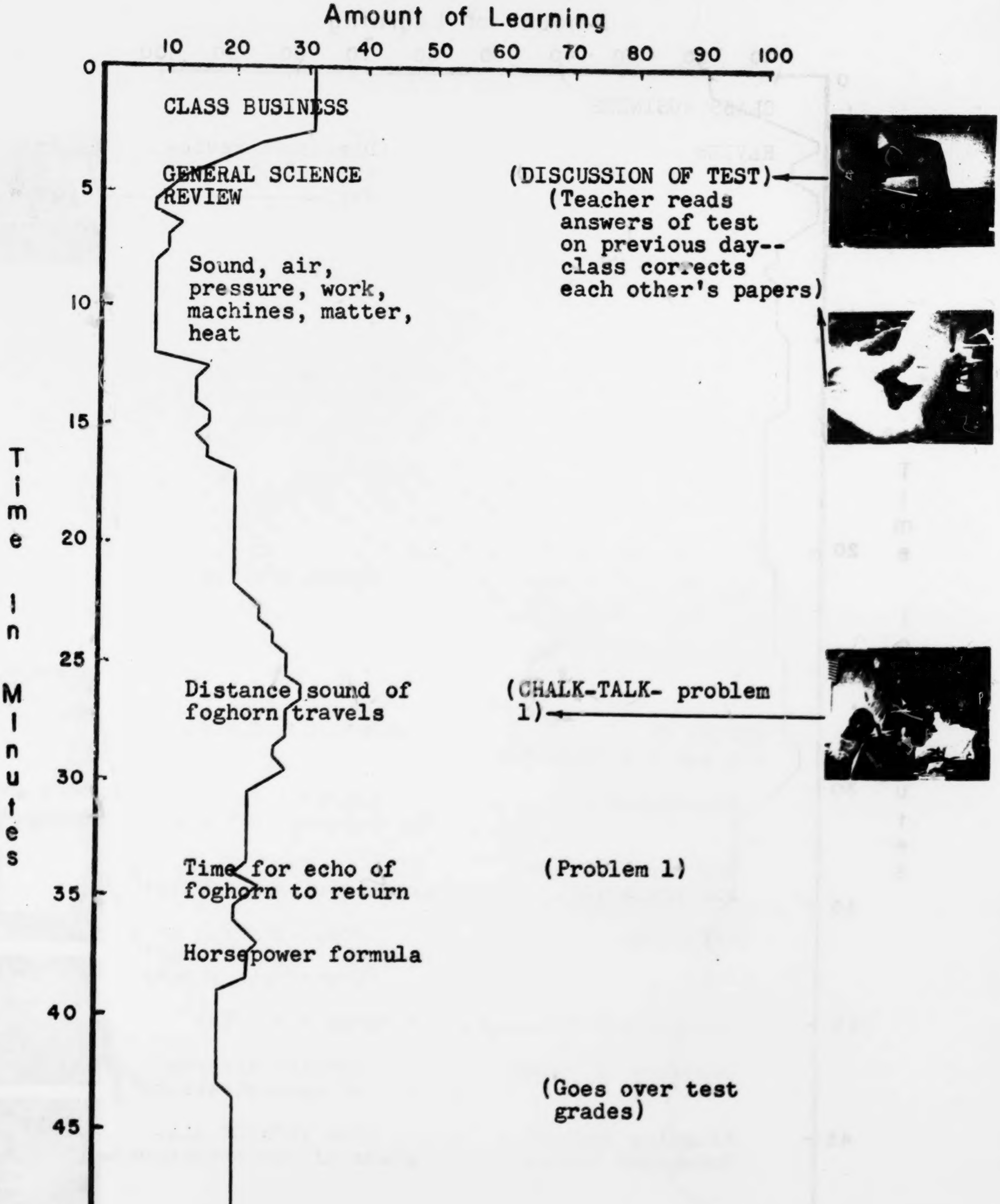
CONTROL GROUP

LEARNING PROFILE NUMBER 147



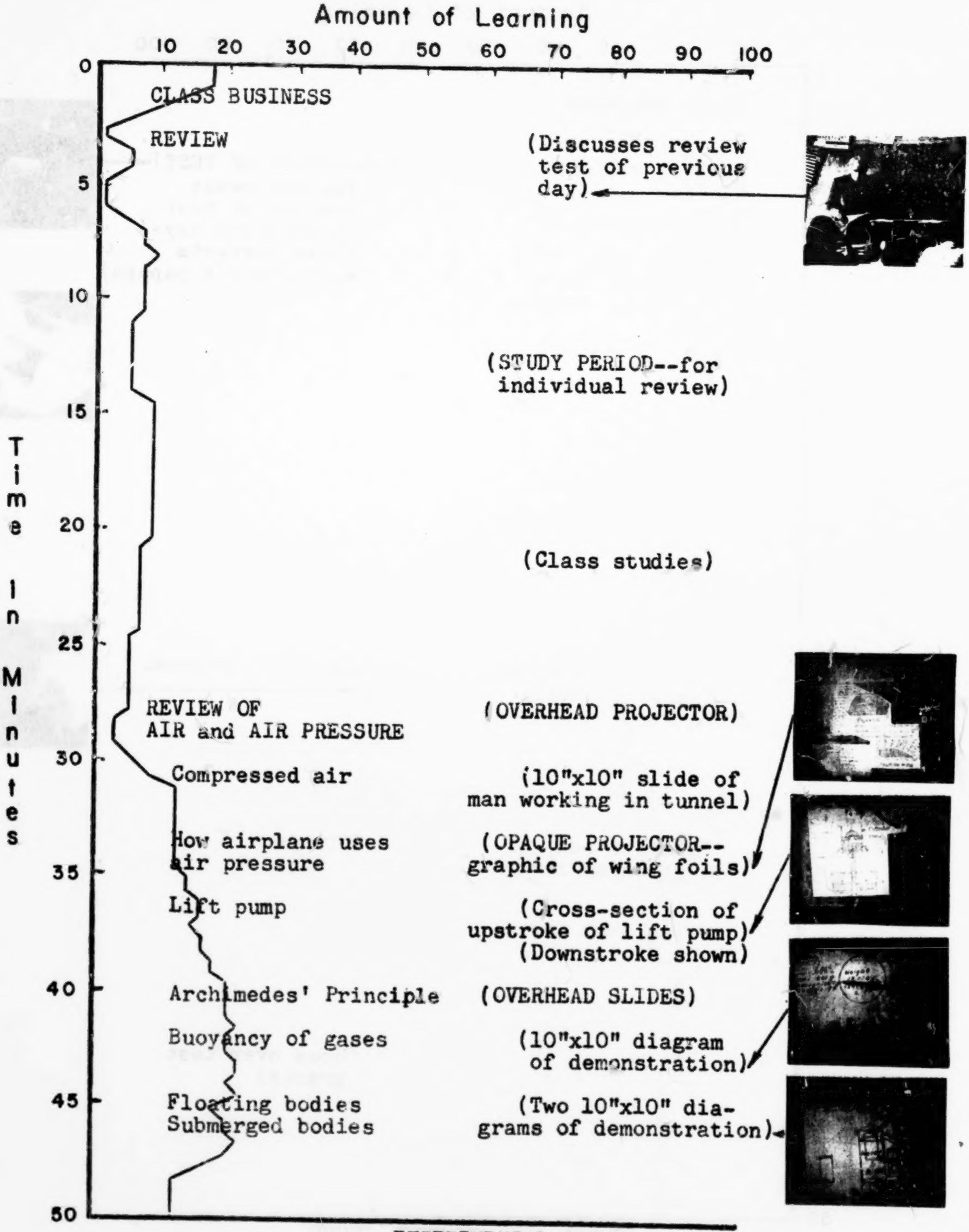
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 148



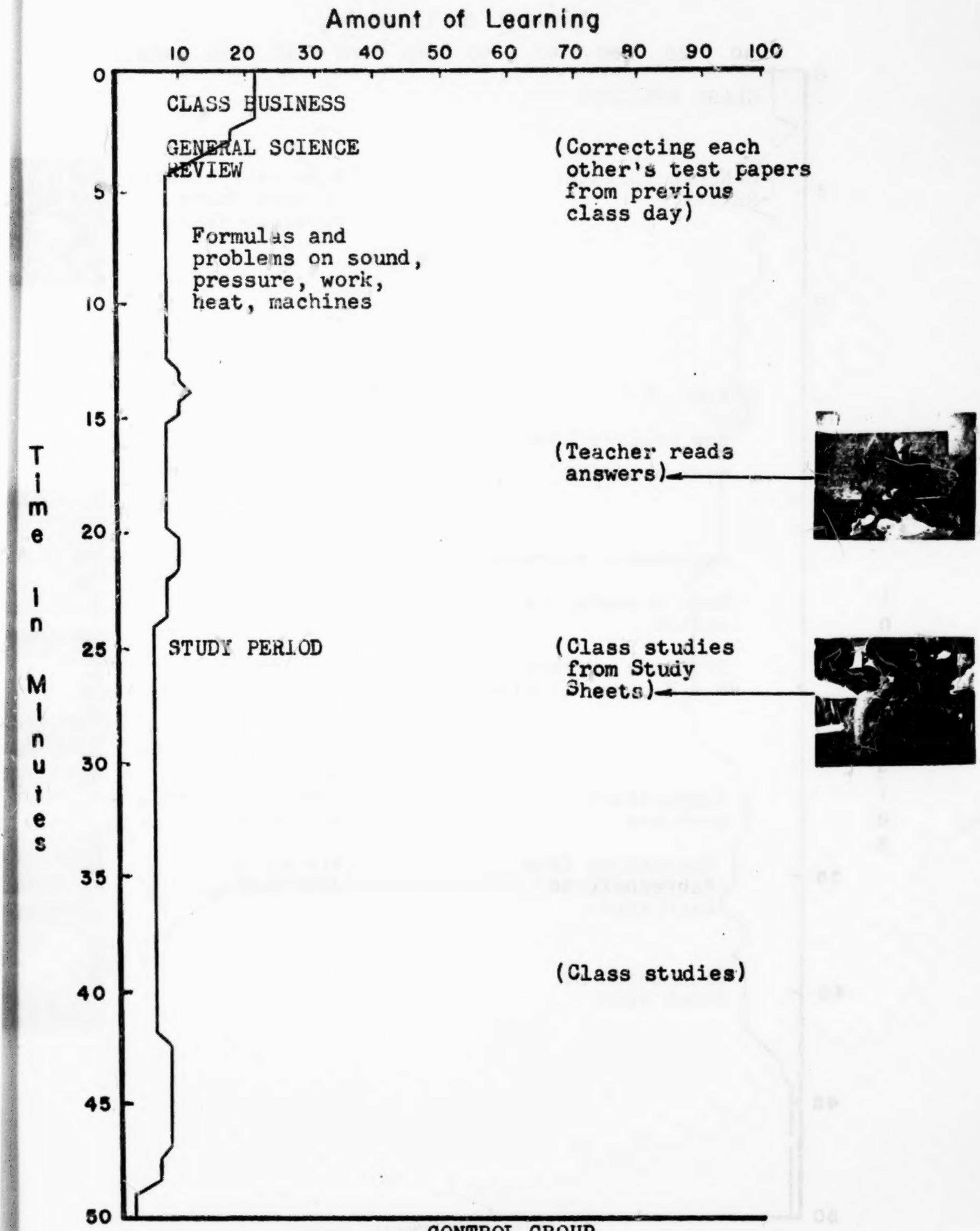
CONTROL GROUP

LEARNING PROFILE NUMBER 149



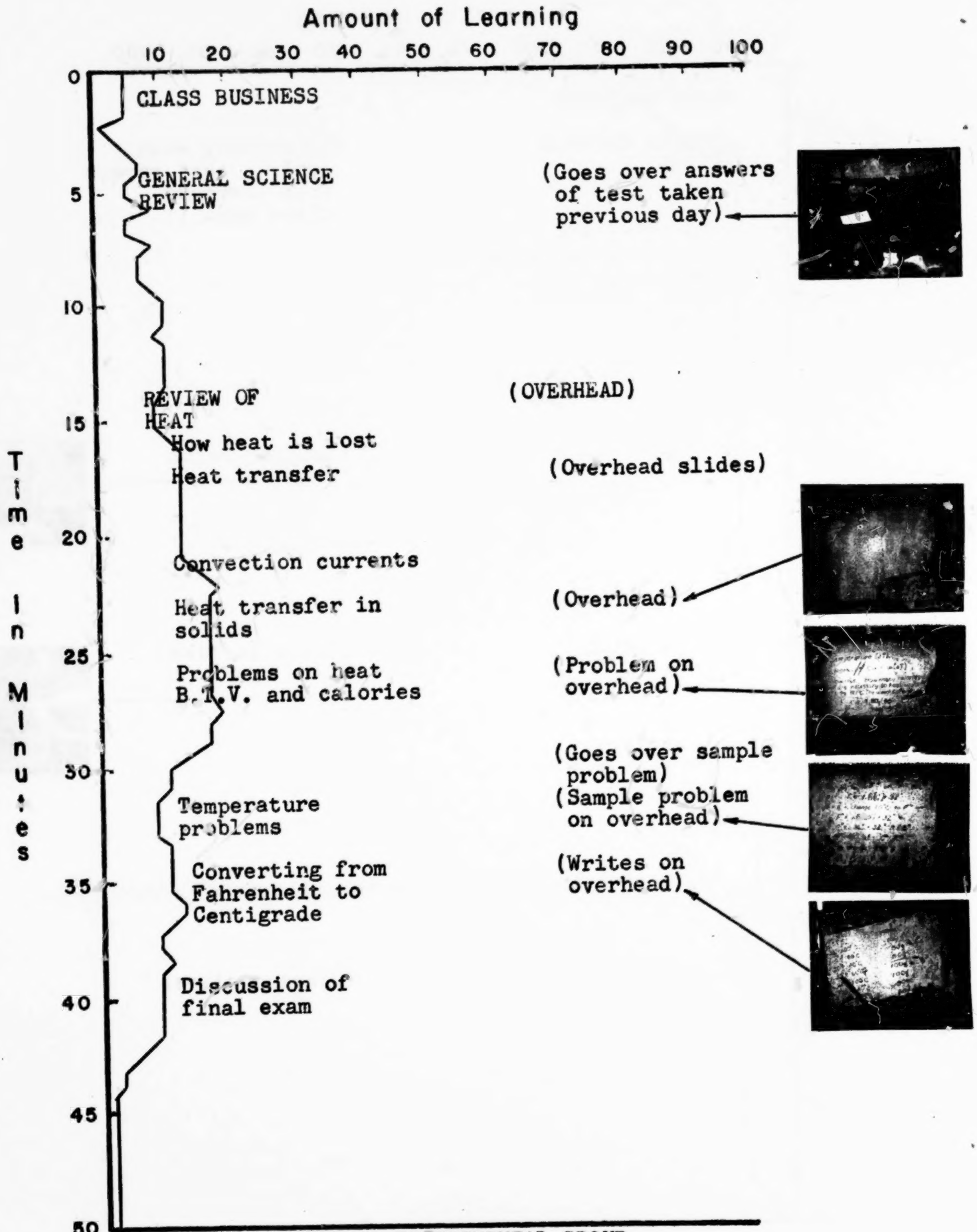
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 150



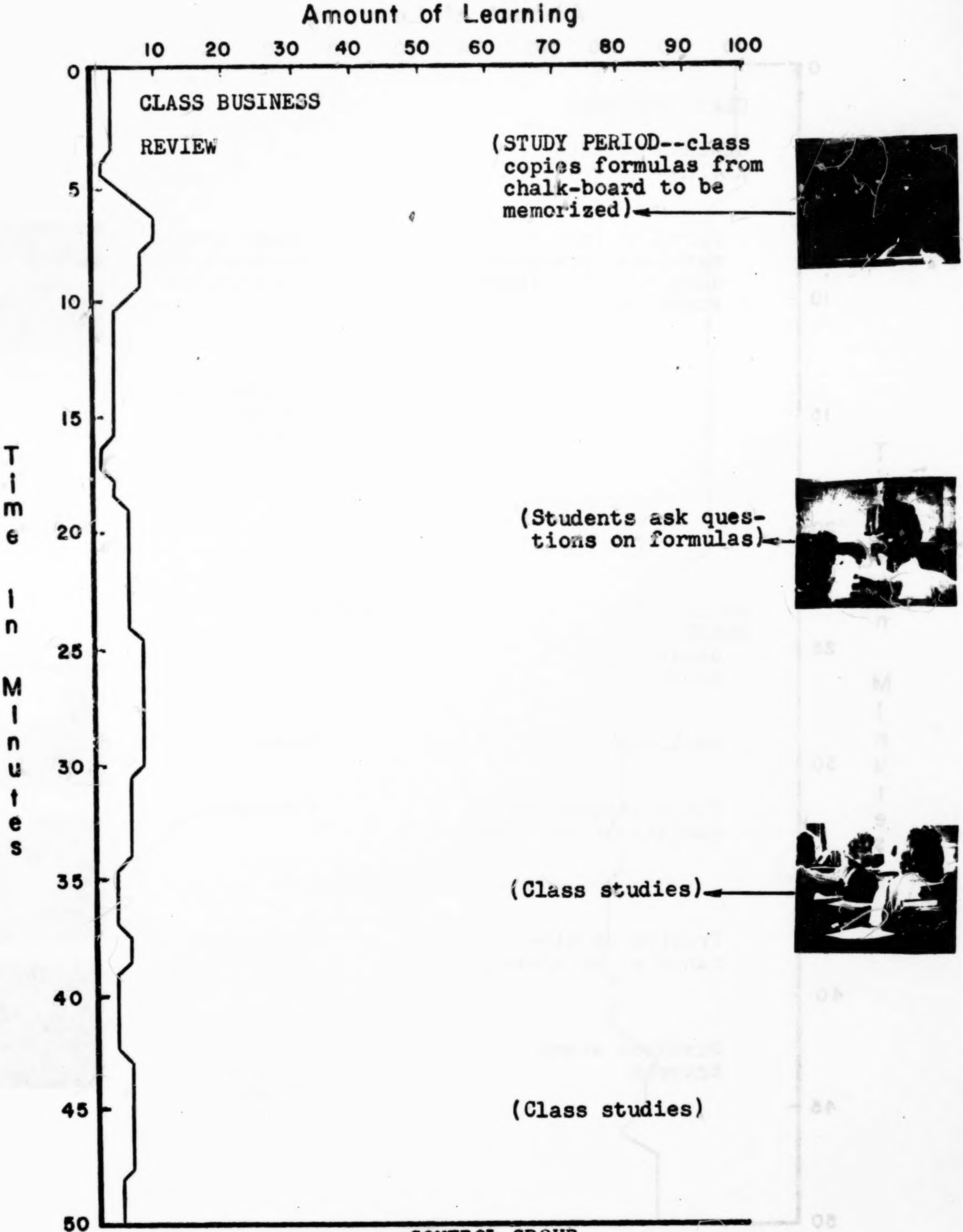
CONTROL GROUP

LEARNING PROFILE NUMBER 151



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 152



(STUDY PERIOD--class copies formulas from chalk-board to be memorized)

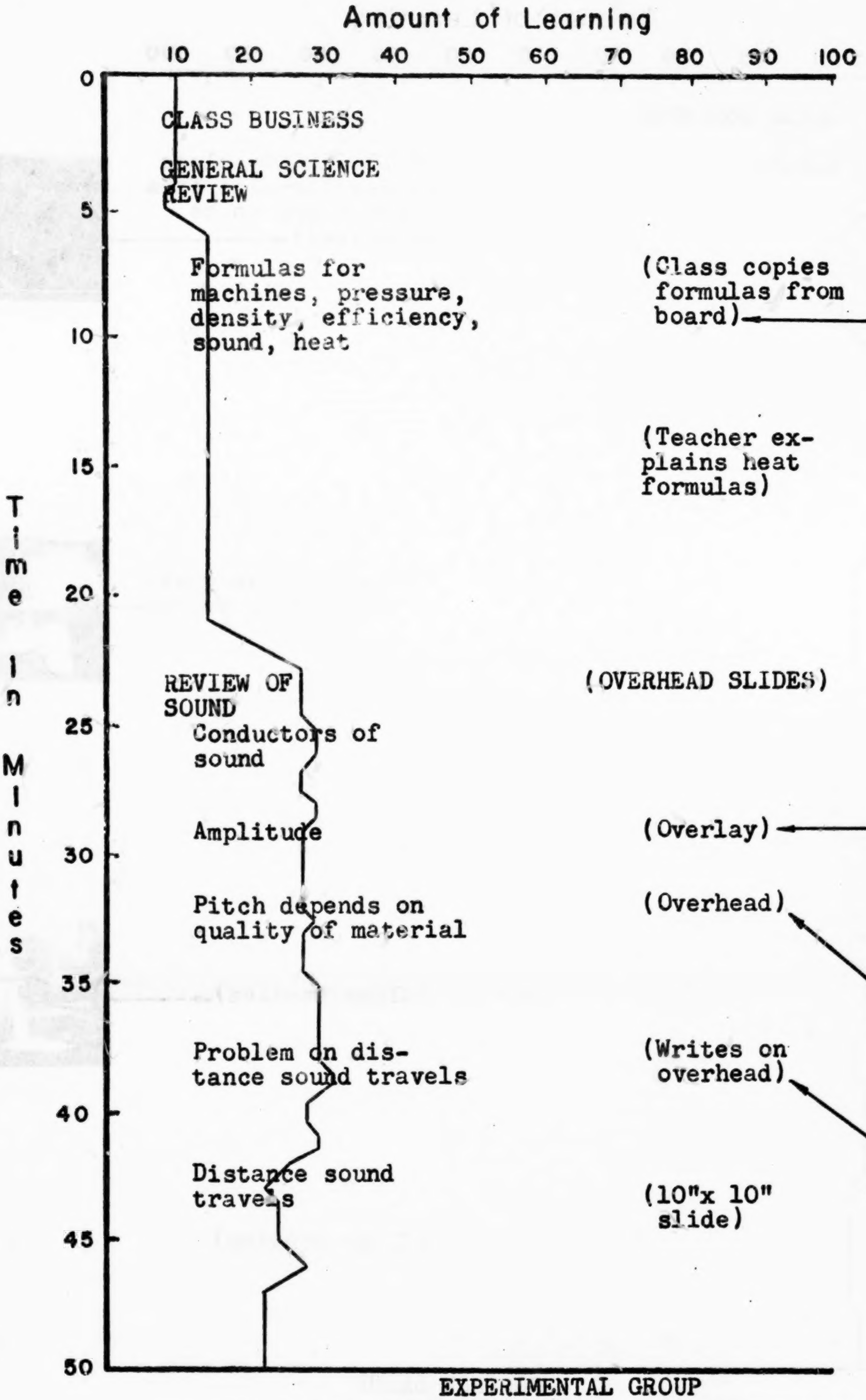
(Students ask questions on formulas)

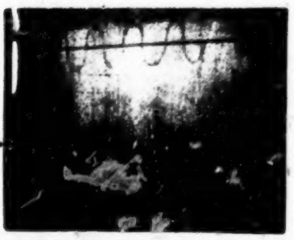
(Class studies)

(Class studies)

CONTROL GROUP

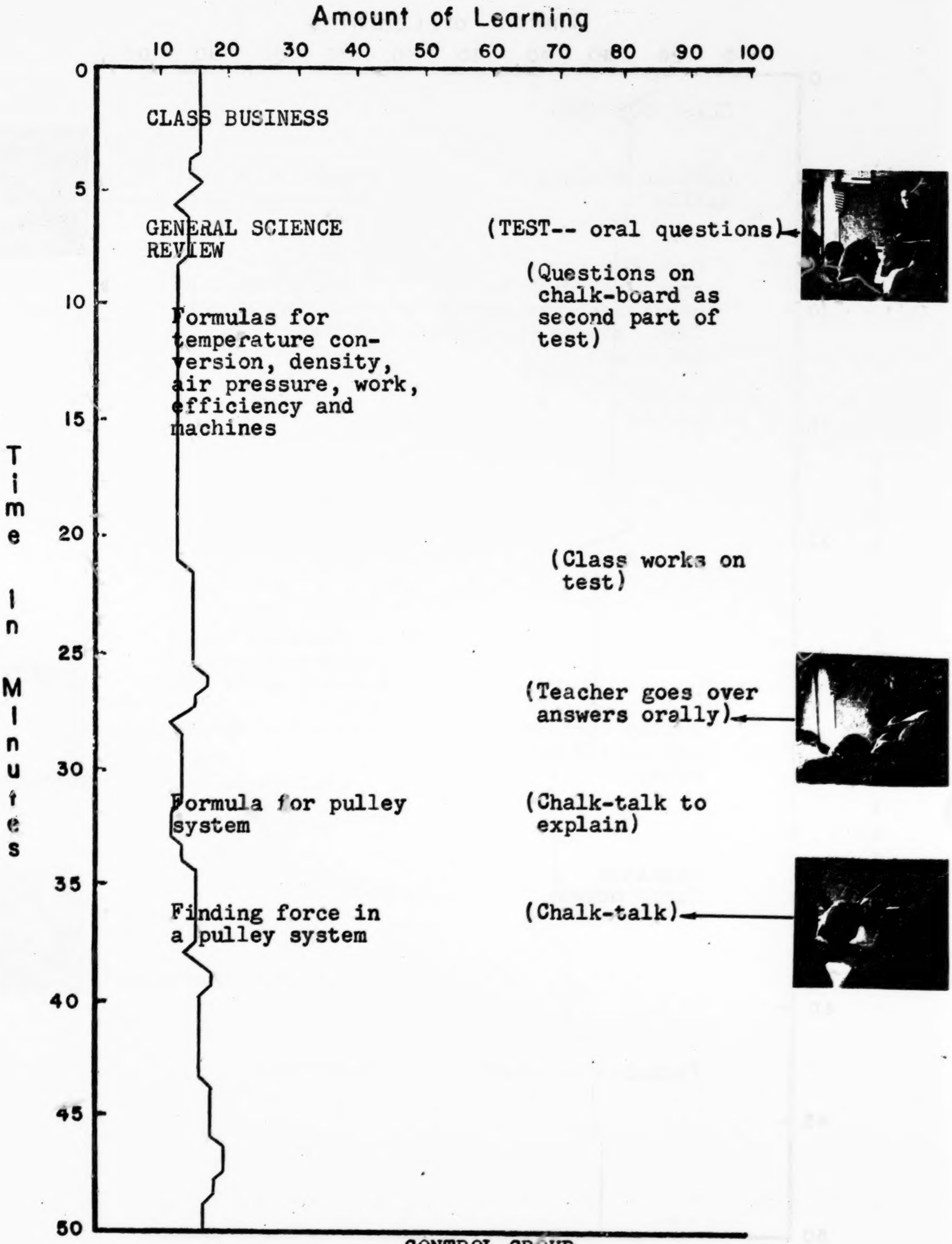
LEARNING PROFILE NUMBER 153





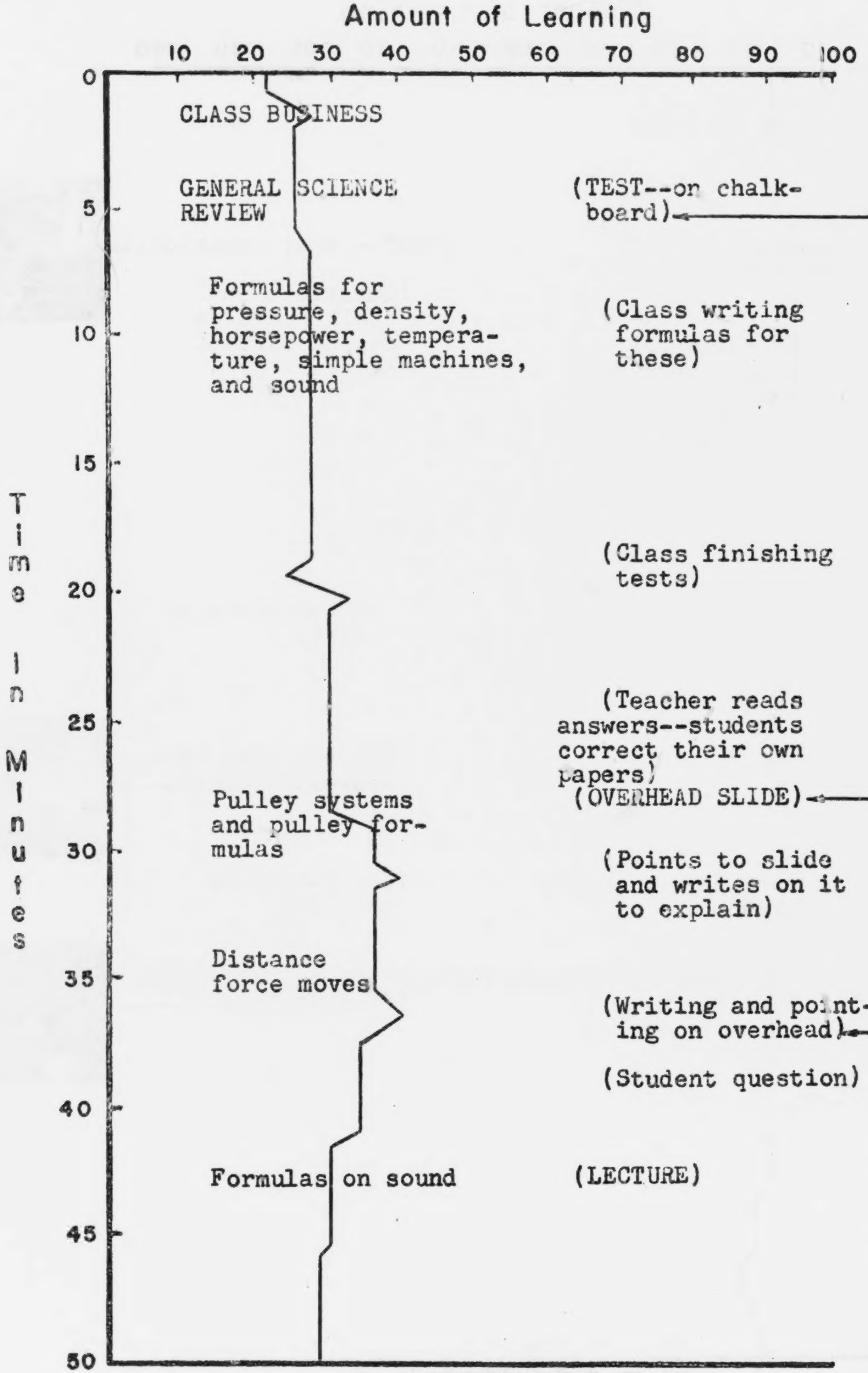
EXPERIMENTAL GROUP

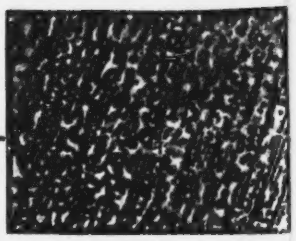
LEARNING PROFILE NUMBER 154

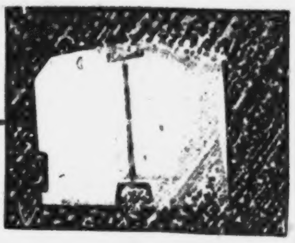


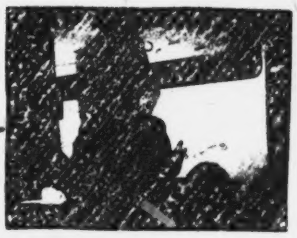
CONTROL GROUP

LEARNING PROFILE NUMBER 155



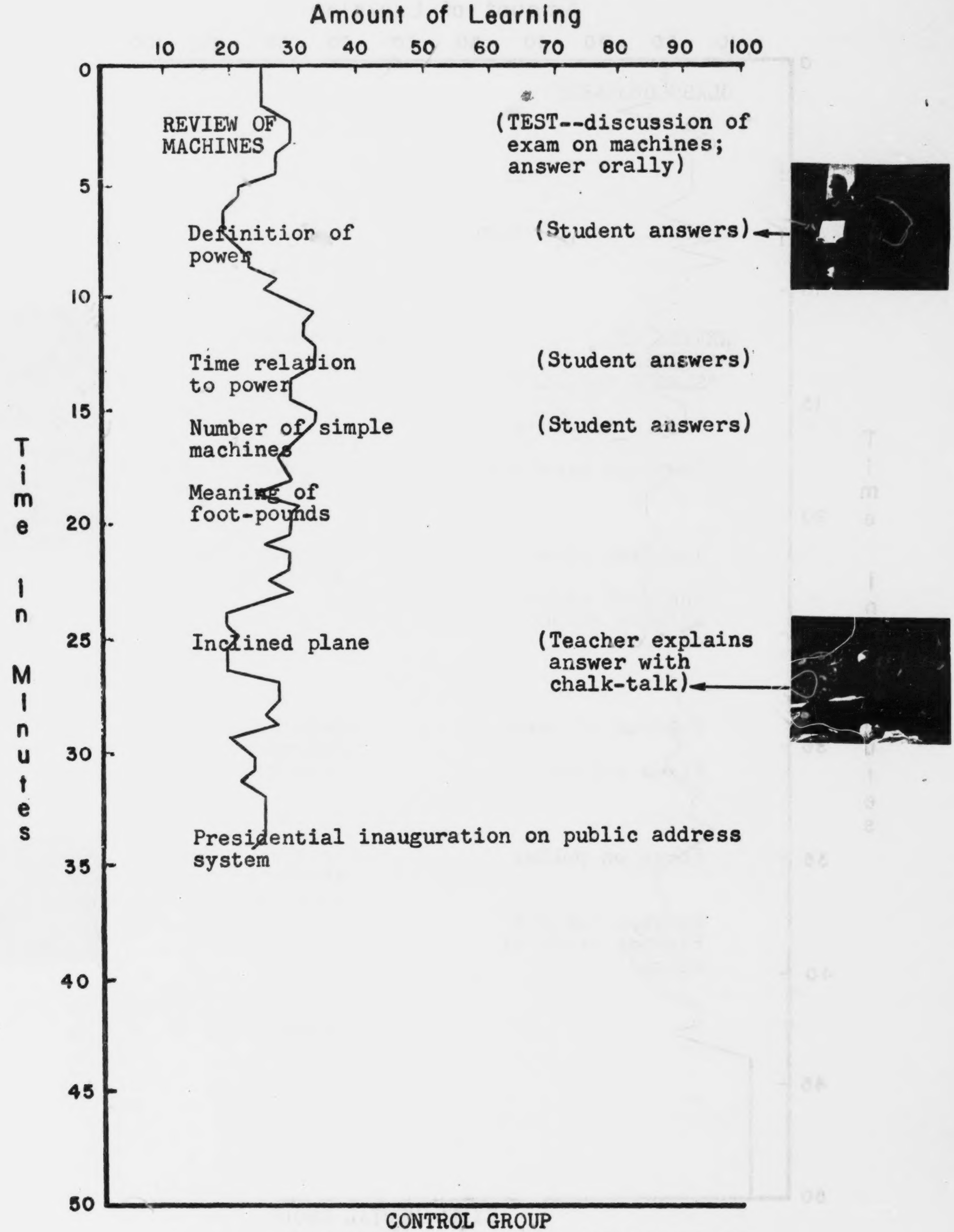






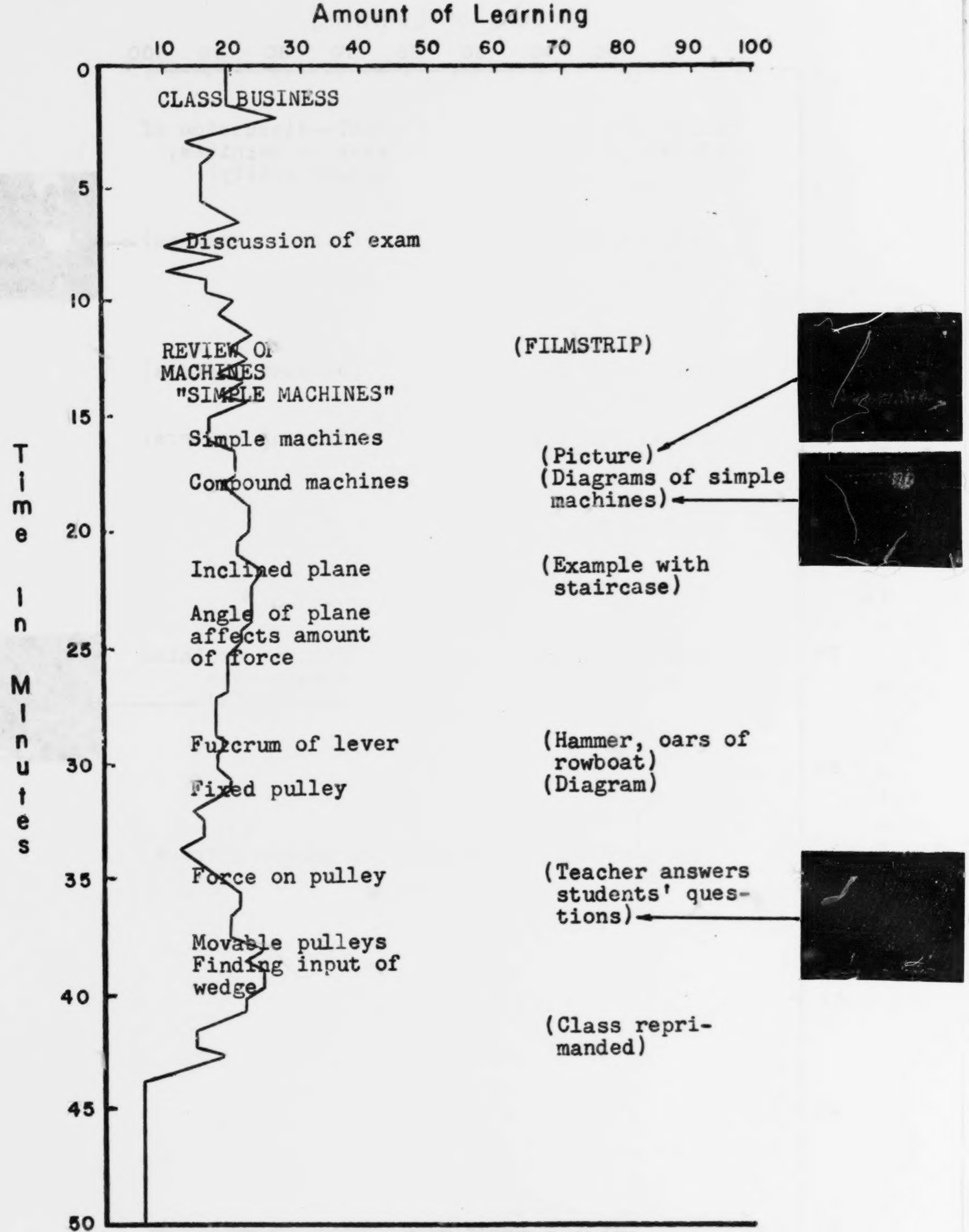
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 156



CONTROL GROUP

LEARNING PROFILE NUMBER 157



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 158

ANALYSIS OF LEARNING PROFILES 139 THROUGH 158

During review for mid-year examinations the profiles were generally low and showed no great variations whether the students reviewed by lecture or by still pictures used previously in the semester. Whether the review was in the Control or Experimental Group, the information was already known by the students and so no great increases in learning resulted, except in a few cases.

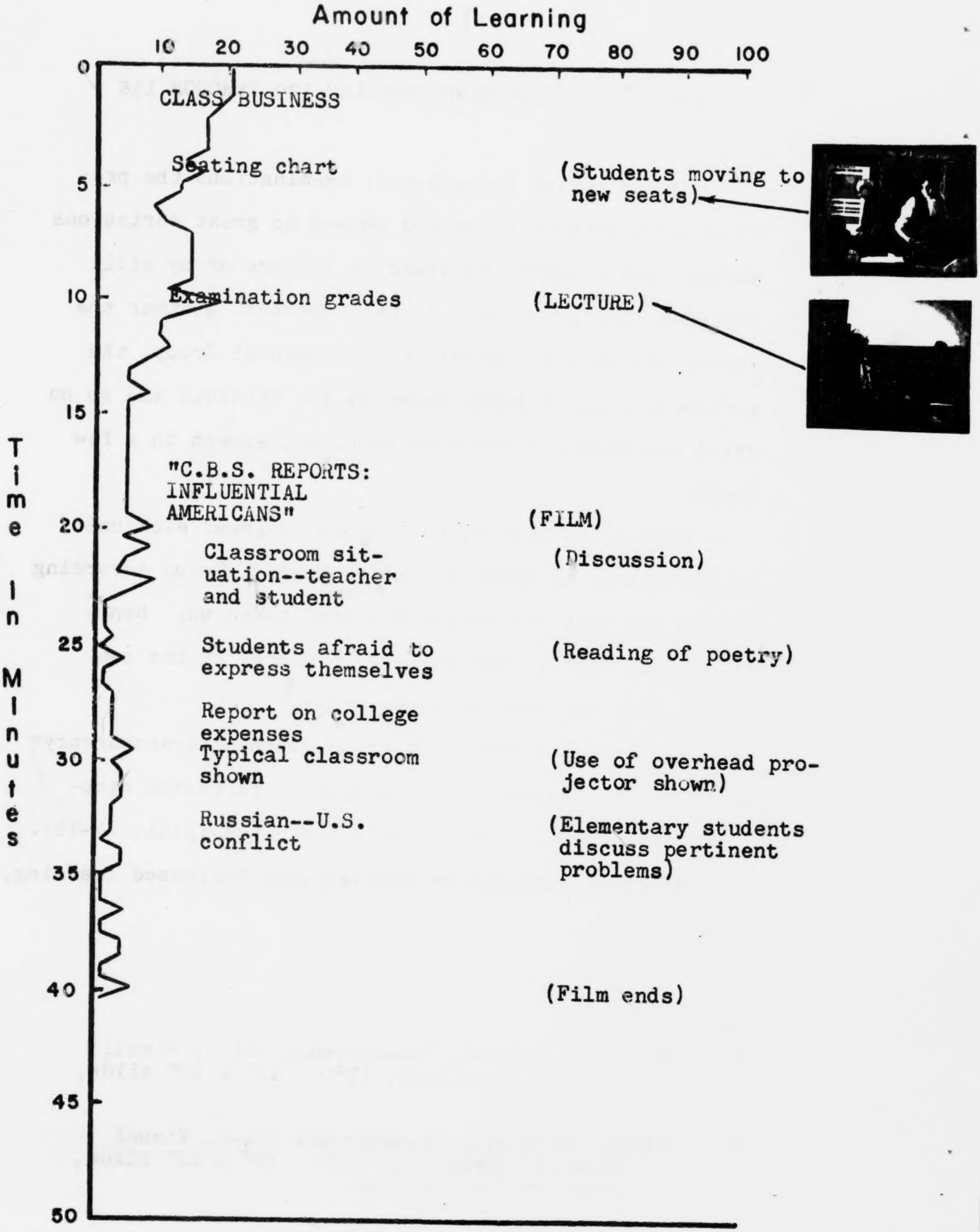
During the review, each group reviewed each unit in the status of Experimental or Control Group according to how the unit had originally been taken up. Hence if a group had studied matter and energy by the new media, they reviewed with new media.

In one Experimental Group an overhead transparency* on which the teacher moved pennies to represent electrons increased learning within the class (E144, 12-16). Another transparency,** an overlay, also increased learning, (E144, 19-22).

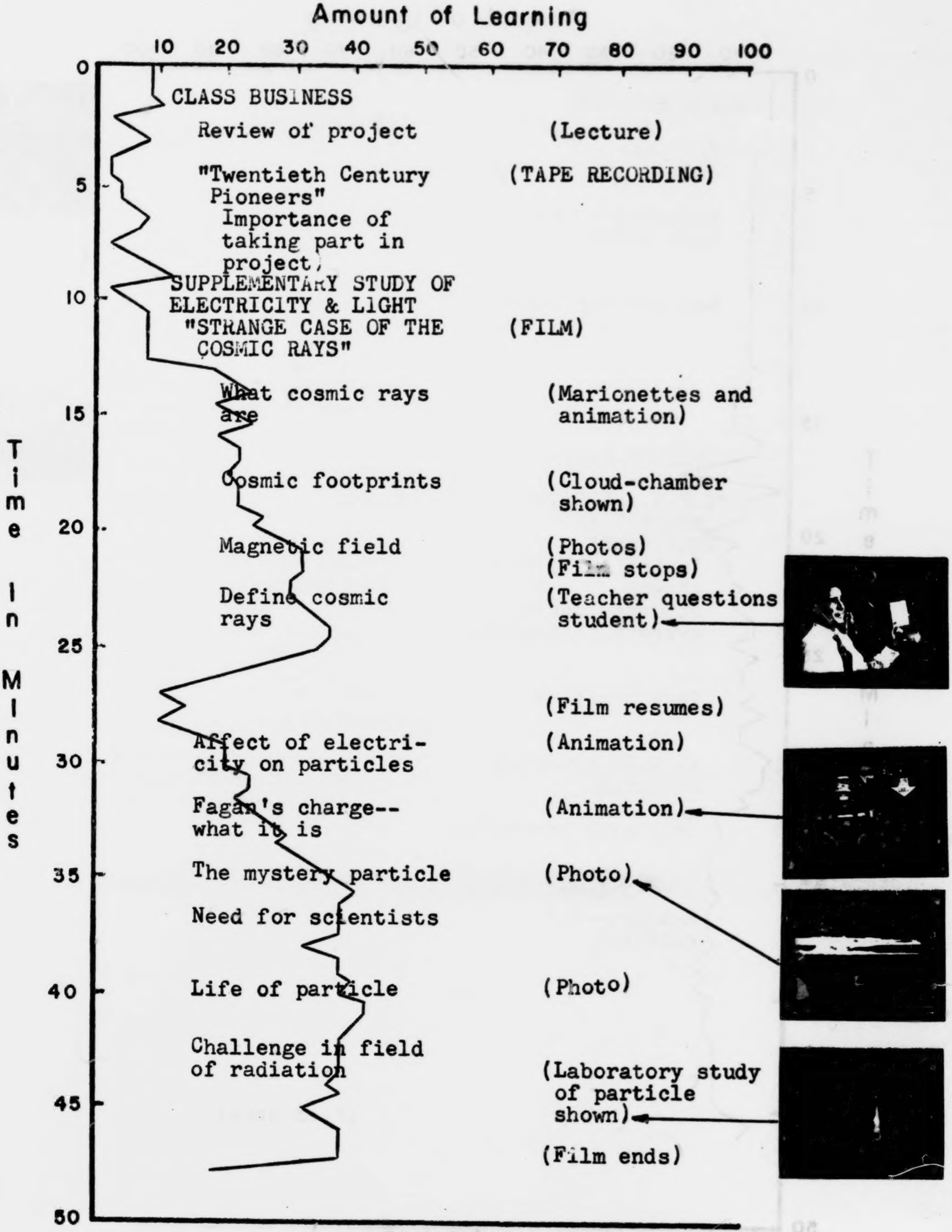
---

* "Electron Shells", Transparency 104-1, Visual Research Institute, 1960. 10" x 10" slide, two colors.

** "Atomic Fission", Transparency 104-5, Visual Research Institute, 1960. 10" x 10" slide, three colors, overlay.

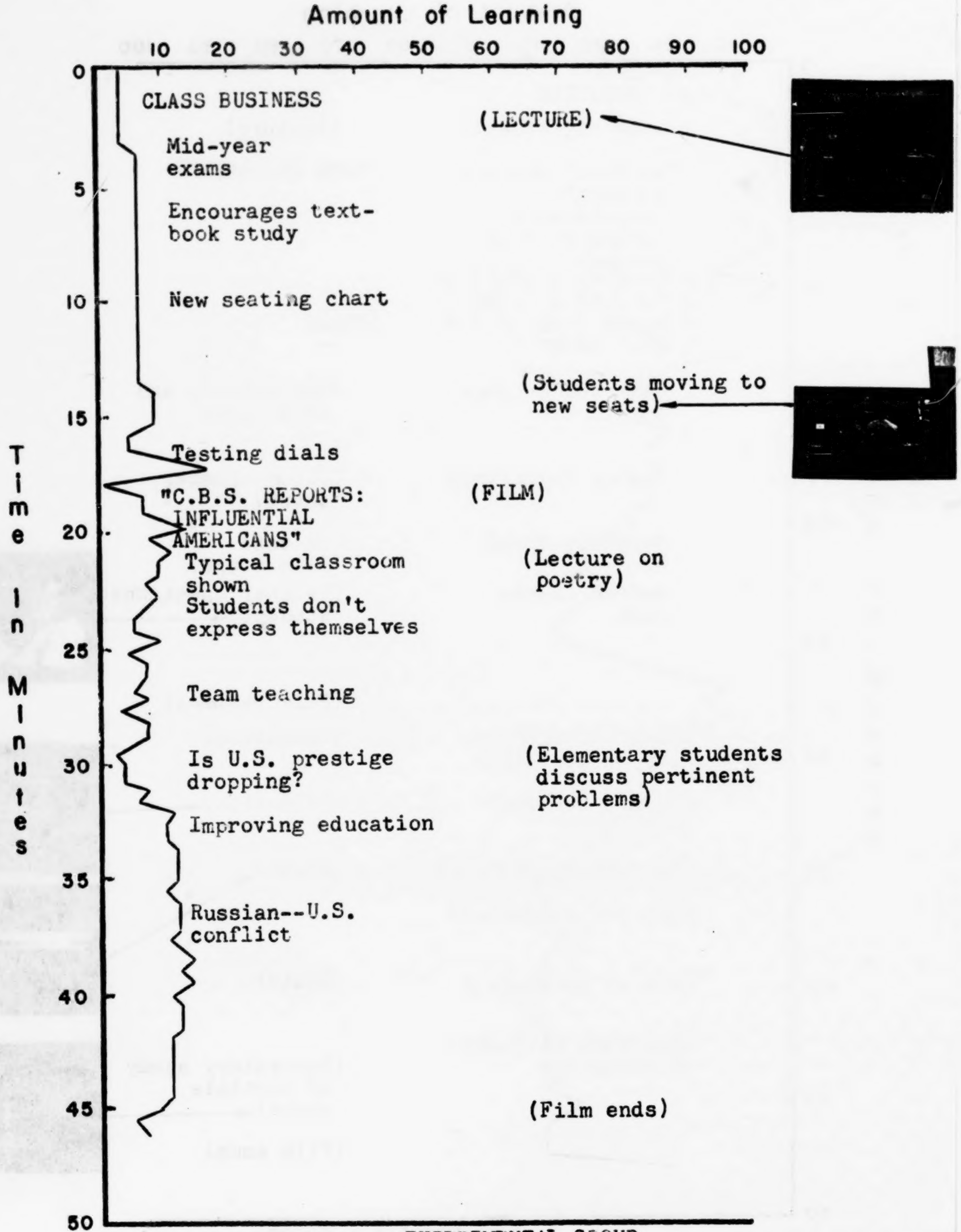


CONTROL GROUP
LEARNING PROFILE NUMBER 159



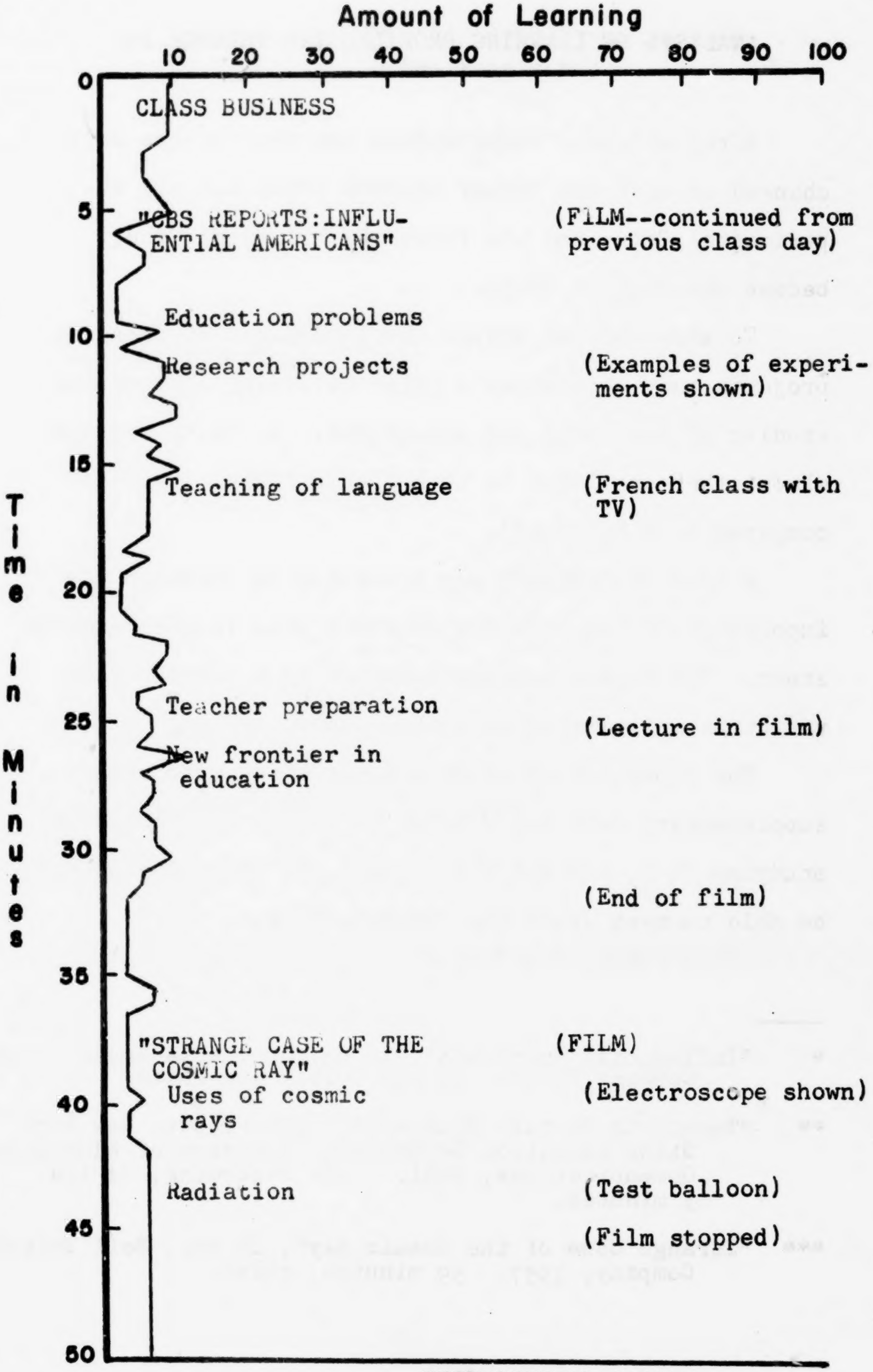
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 160



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER F



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER G

ANALYSIS OF LEARNING PROFILES 159 THROUGH 160
and also F and G

After mid-year examinations the two classes were changed so that the former Control Group was the Experimental Group and the former Experimental Group became the Control Group.

To show the two groups the importance of research projects they were shown a film* reviewing some of the studies of new media and procedures. Learning reached almost the same level in both groups (C159, 18-40 as compared to E F, 20-47).

A tape recording** was presented to indicate the importance of the part the students play in the research study. The tape recording resulted in a ten per cent variation in learning in both groups.

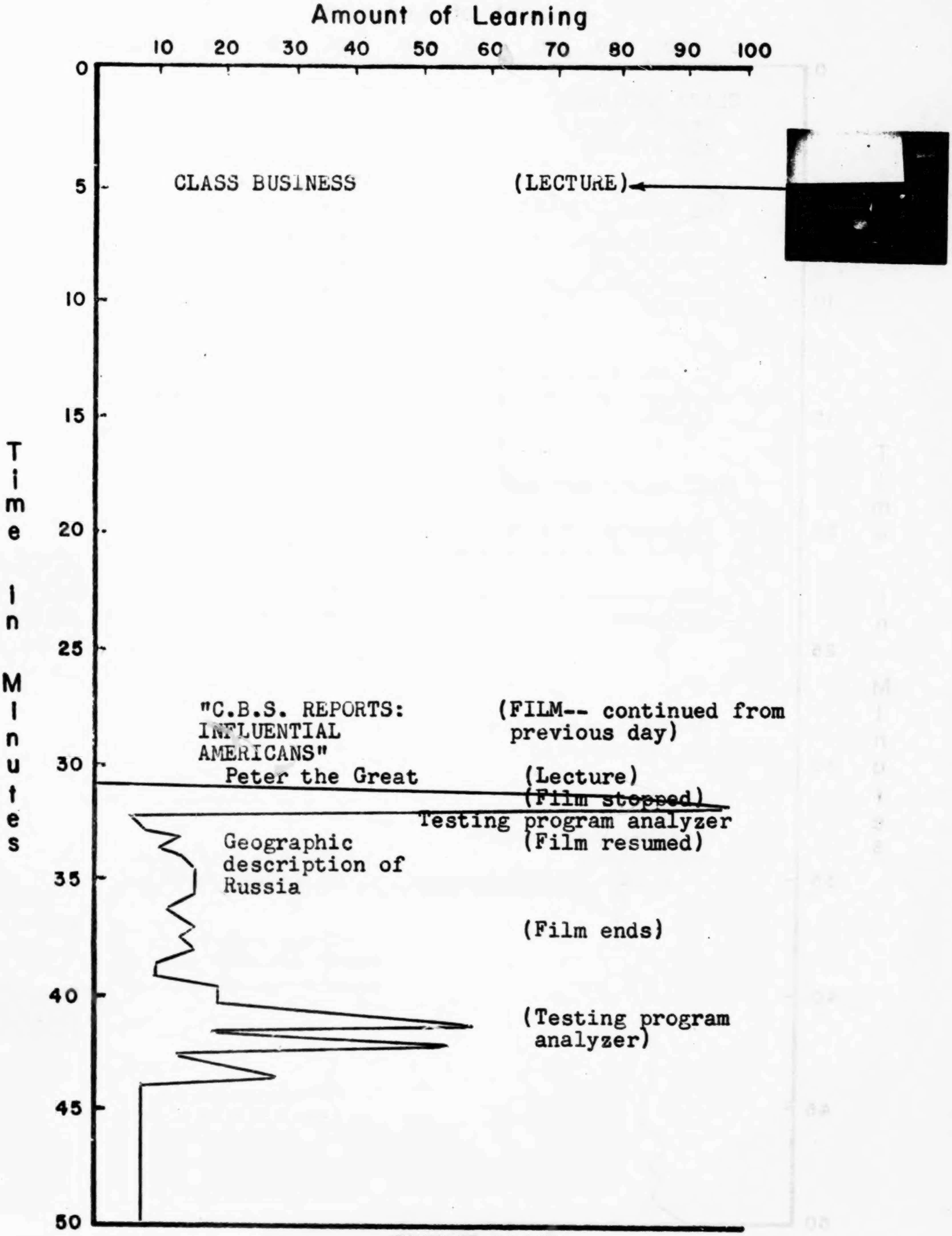
The experimental Group was presented with some supplementary material*** related to topics they would be studying (E F, E G and E162, 5-15), so that they would be able to meet after the Control Group.

---

* "Influential Americans", 16 mm., Columbia Broadcasting Company, 1960. 51 min, black and white

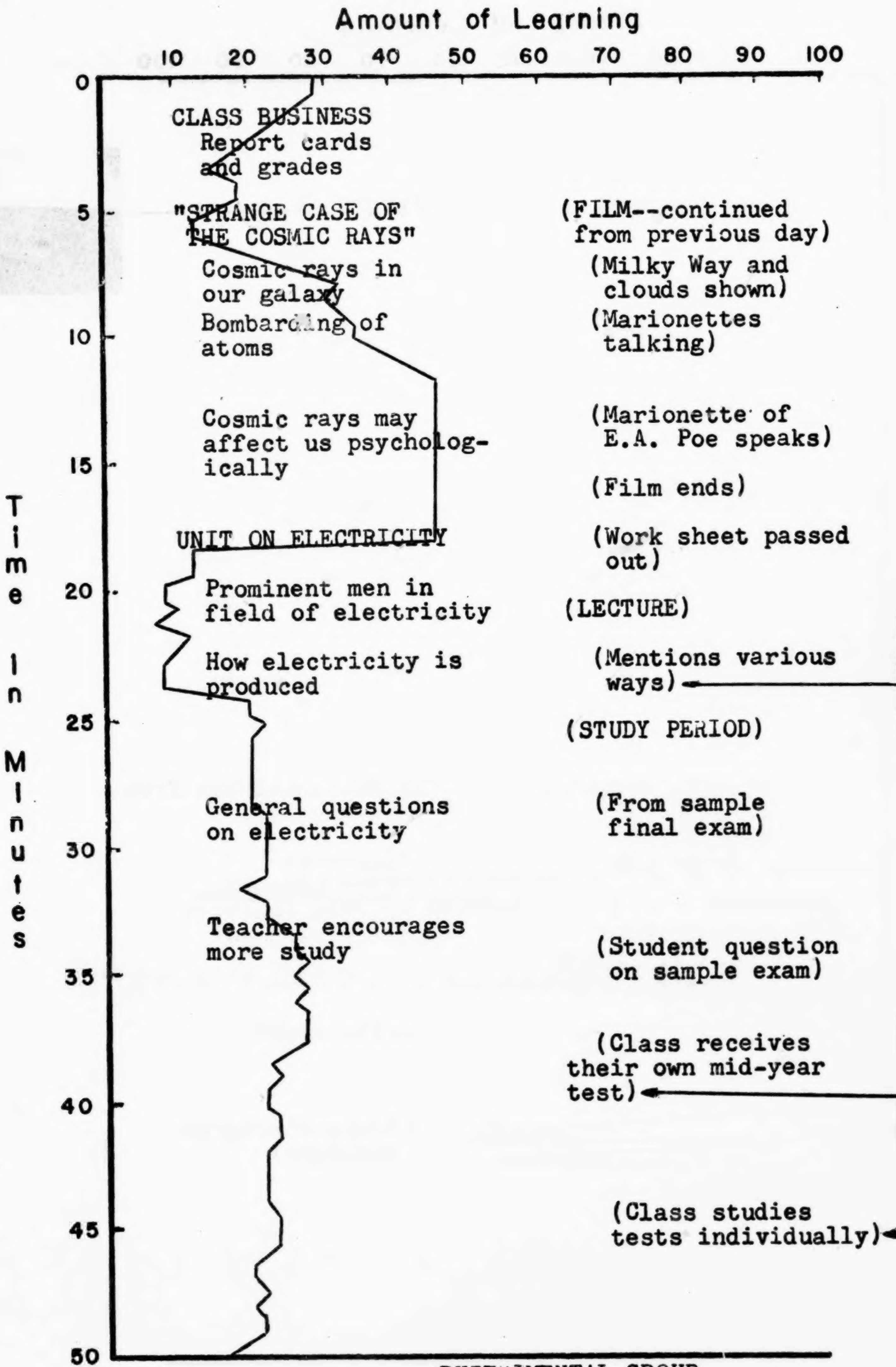
** "Twentieth Century Pioneers", John Hutzky, New York State Education Department, Division of Educational Communications, 1961. Tape recording, 7½ ips, 5 minutes.

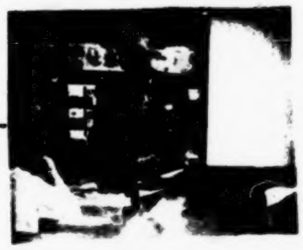
*** "Strange Case of the Cosmic Ray", 16 mm., Bell Telephone Company, 1957, 59 minutes, color.



CONTROL GROUP

LEARNING PROFILE NUMBER 161





EXPERIMENTAL GROUP

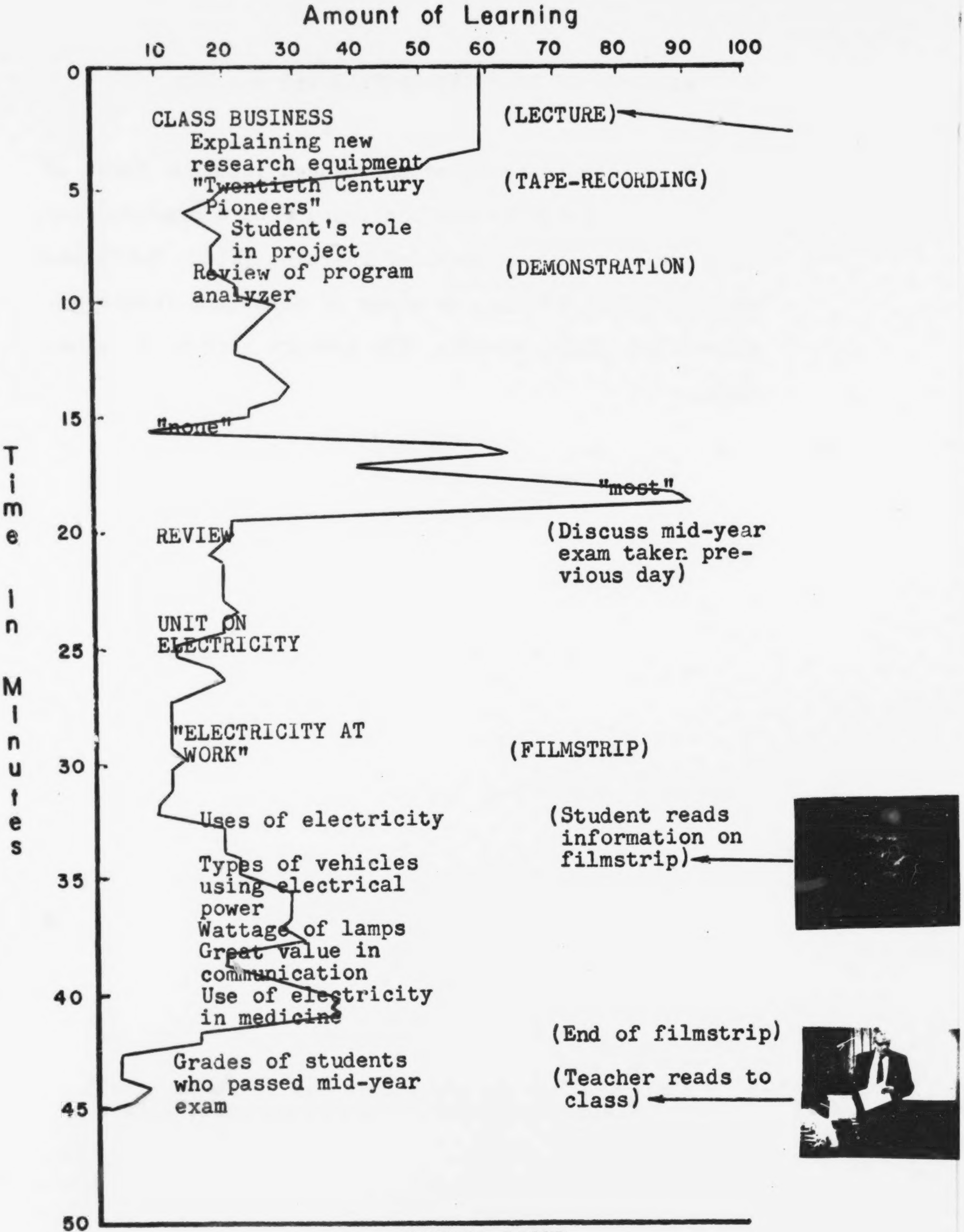
LEARNING PROFILE NUMBER 162

ANALYSIS OF LEARNING PROFILE 161 and 162

A supplementary film* introduced into the first of class, even though it was continued from a previous day, resulted in a higher level of learning (E162, 5-17) than lecture (E162, 18-23), or study of texts and sample examinations (E162, 24-46). The lecture introduced a new unit.

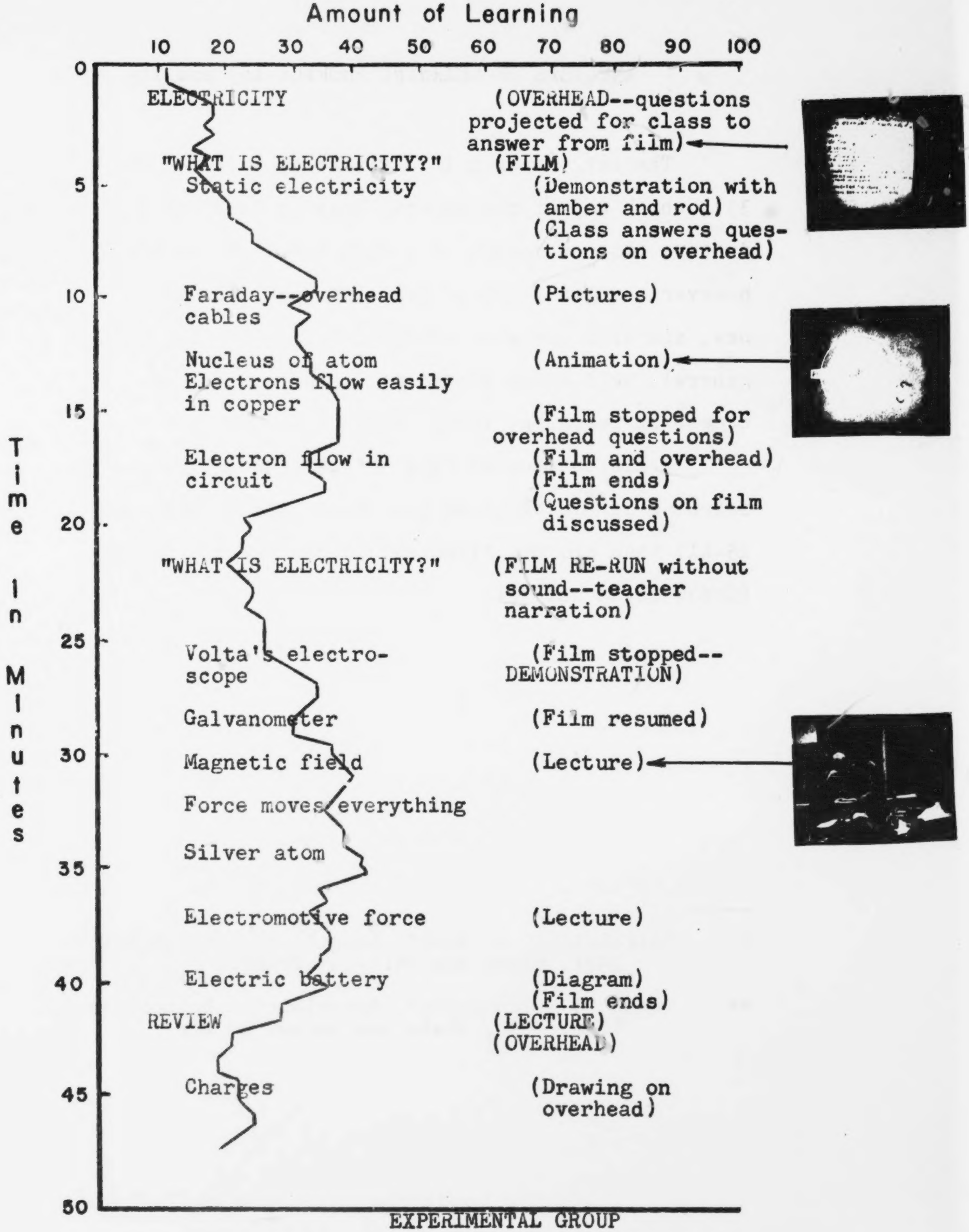
---

* "Strange Case of the Cosmic Ray", 16 mm., Bell Telephone Company, 1957, 59 minutes, color.



CONTROL GROUP

LEARNING PROFILE NUMBER 163



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 164

ANALYSIS OF LEARNING PROFILE 163 and 164

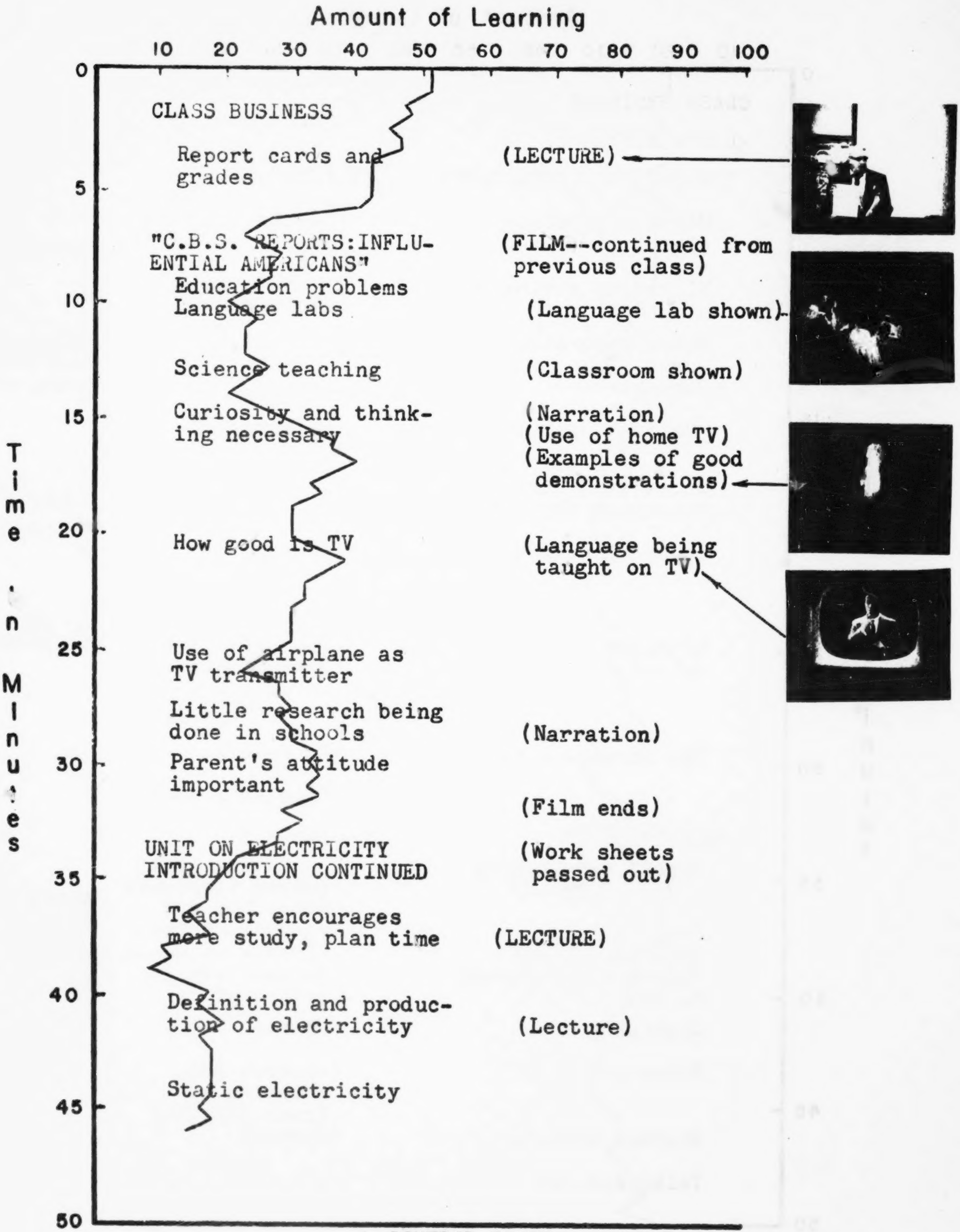
The introduction in a filmstrip,* (C163, 30-33), which was of the general uses in home and industry, did not result in a high level of learning; however, a high point of learning resulted when a new, specific use was presented (C163, 40-41). A general, well-known statement caused a sharp decrease in learning, (C163, 38).

A motion picture film ** resulted in greater learning in the Experimental Group (E164, 8-18, and 25-41) than did the filmstrip in the Control Group (C163, 28-35 and 38).

---

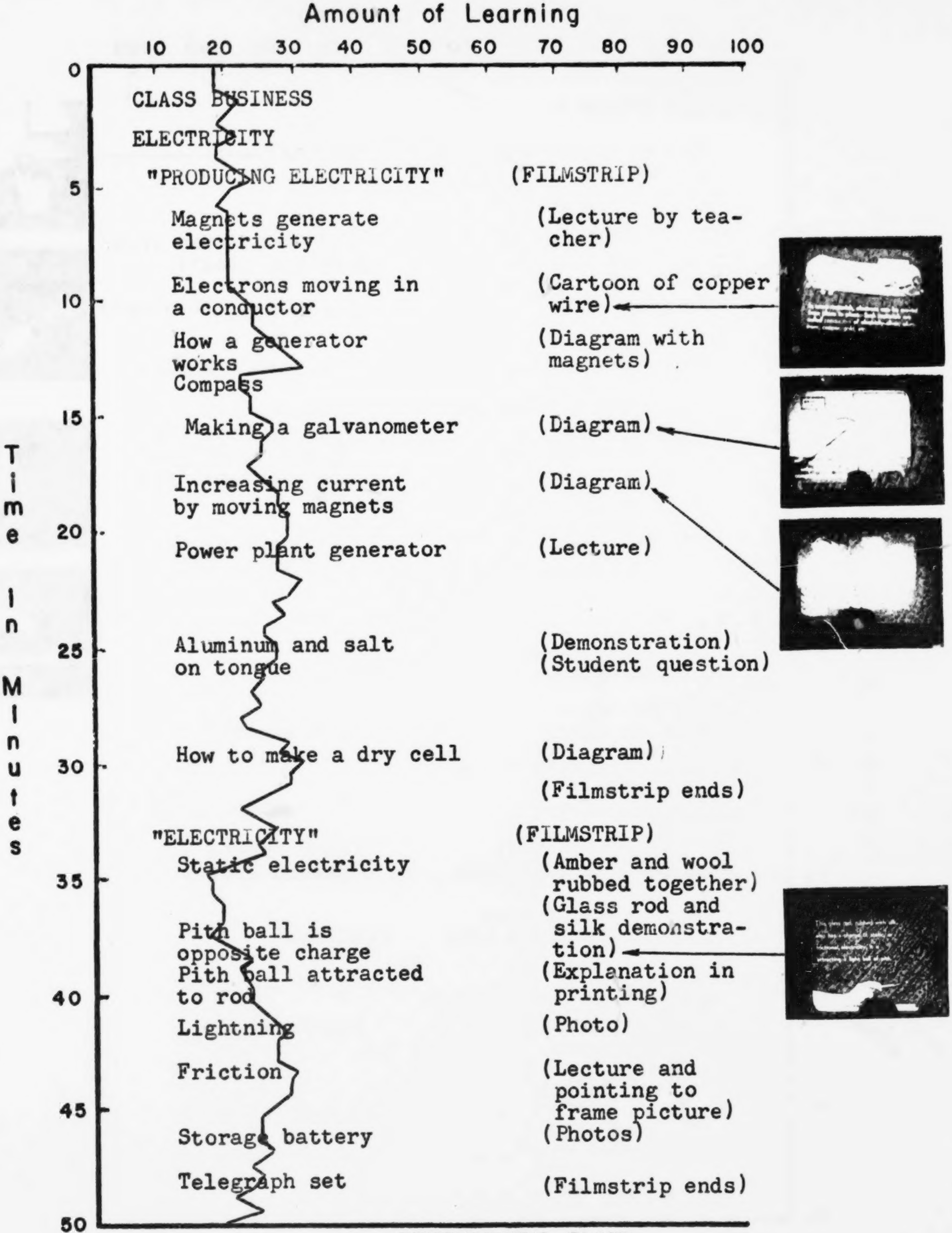
* "Electricity at Work", Long Filmslide Service, 1951, black and white, 47 frames.

** "What is Electricity", Encyclopedia Britannica Film, 1953, black and white, 20 min.



CONTROL GROUP

LEARNING PROFILE NUMBER 165



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 166

ANALYSIS OF LEARNING PROFILE 165 and 166

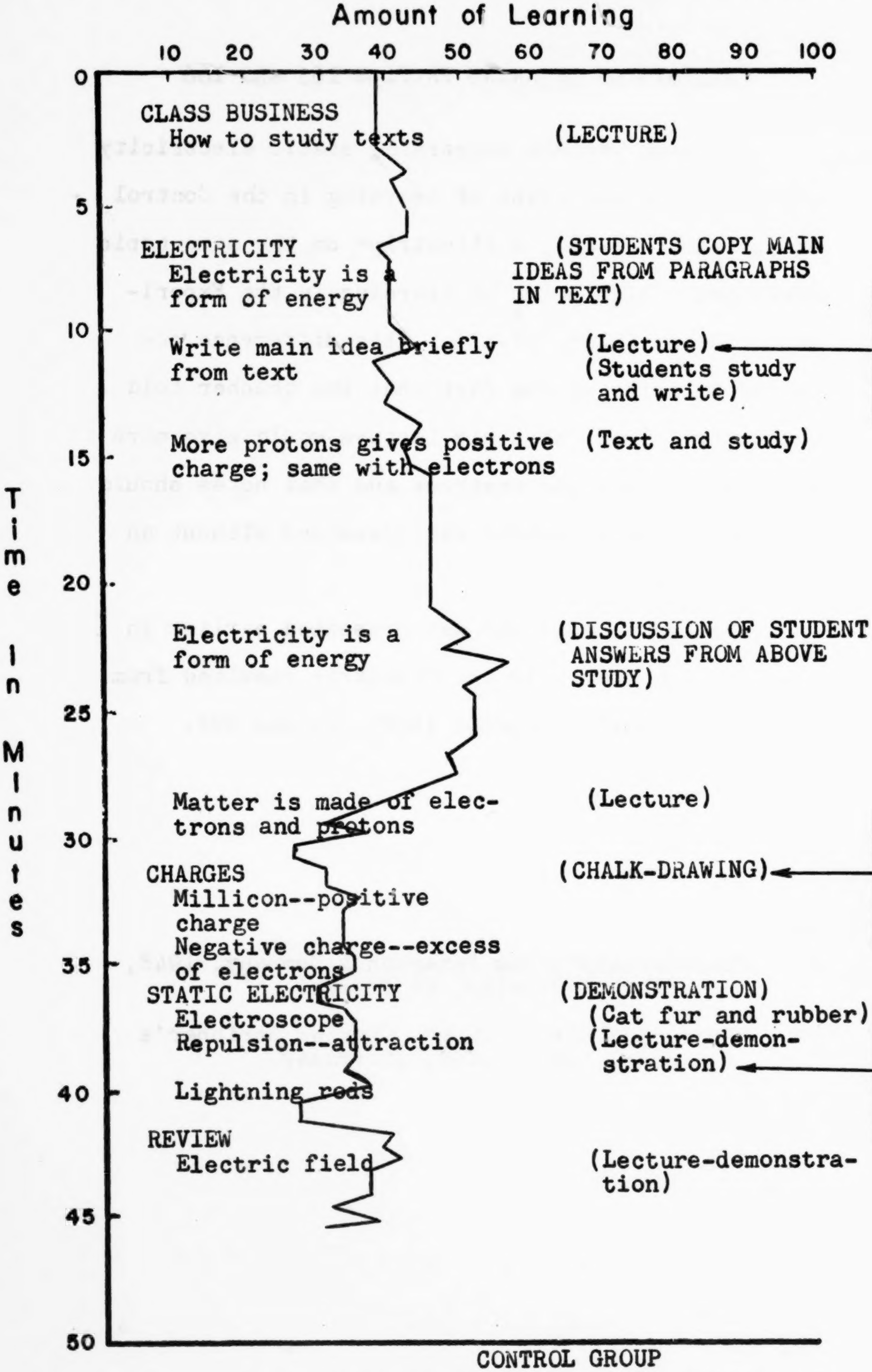
Although lecture concerning static electricity resulted in a low point of learning in the Control Group (C165, 43-46), a filmstrip* on the same topic developed a high point in learning in the Experimental Group (E166, 37-43). This difference occurred in spite of the fact that the teacher told the Control Group that his lecture would give more information than the textbook and that notes should be taken. The filmstrip was presented without an introduction.

Another filmstrip** was presented earlier in class. High points in the filmstrip resulted from diagrams of useful objects (E166, 13 and 30).

---

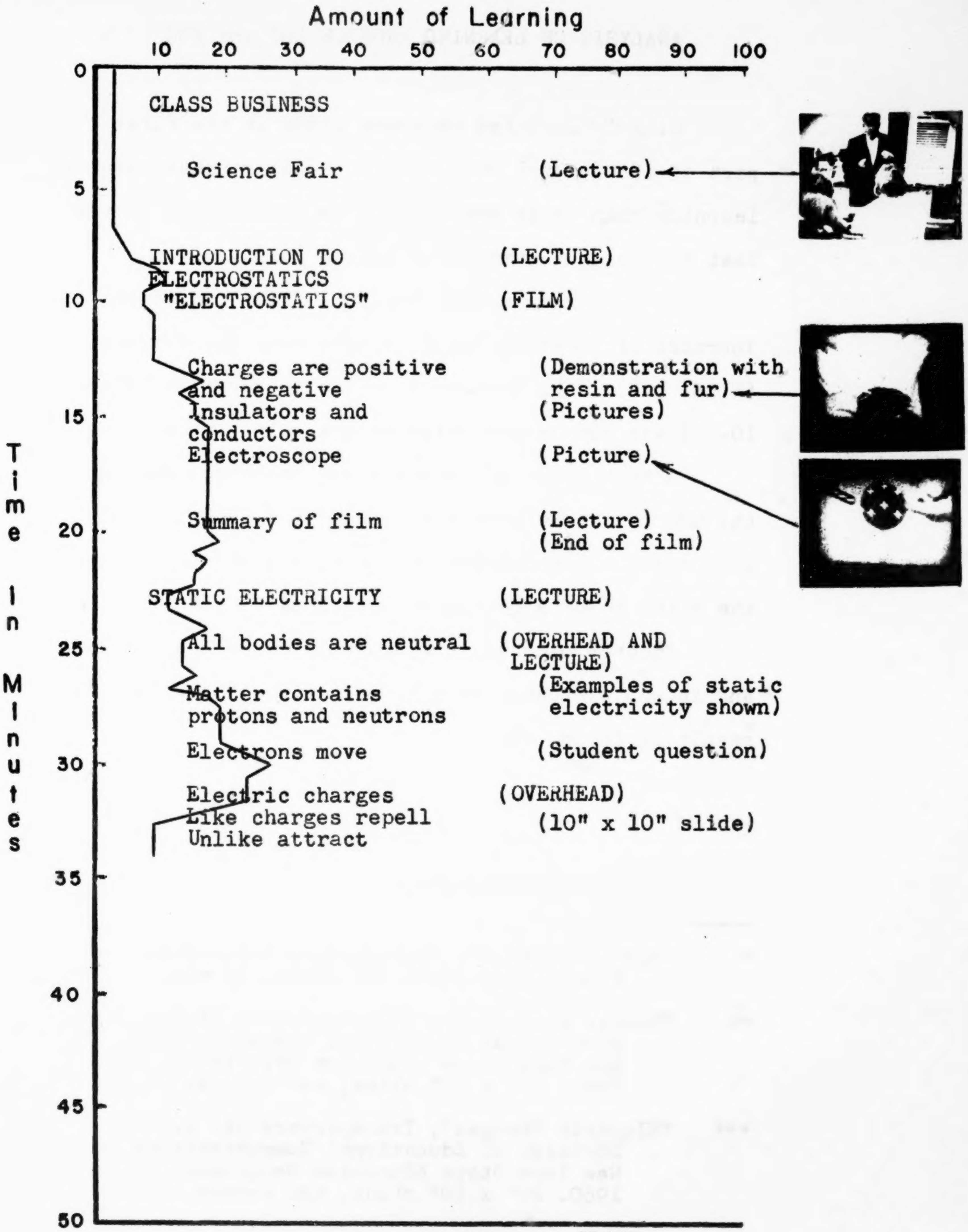
* "Electricity", Row Peterson & Company, 1948, black and white, 48 frames.

** "Producing Electricity", Charles Scribner's Sons, 1957, color, 32 frames.



CONTROL GROUP

LEARNING PROFILE NUMBER 167



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 168

ANALYSIS OF LEARNING PROFILE 167 and 168

Closely directed textbook study in the first part of the Control Group (C167, 3-26) yielded greater learning than chalk drawing and demonstrations in the last part of the same class period (C167, 29-45).

In the Experimental Group, a film* caused an increase of learning (E168, 10-20) over the lecture (E168, 1-8). The introduction within the film (E168, 10-13) was not as effective as the rest of the film.

A high point of learning was developed during the use of an overhead transparency ** (E168, 29-31) at a point where student curiosity was stimulated by the slide to ask a pertinent question.

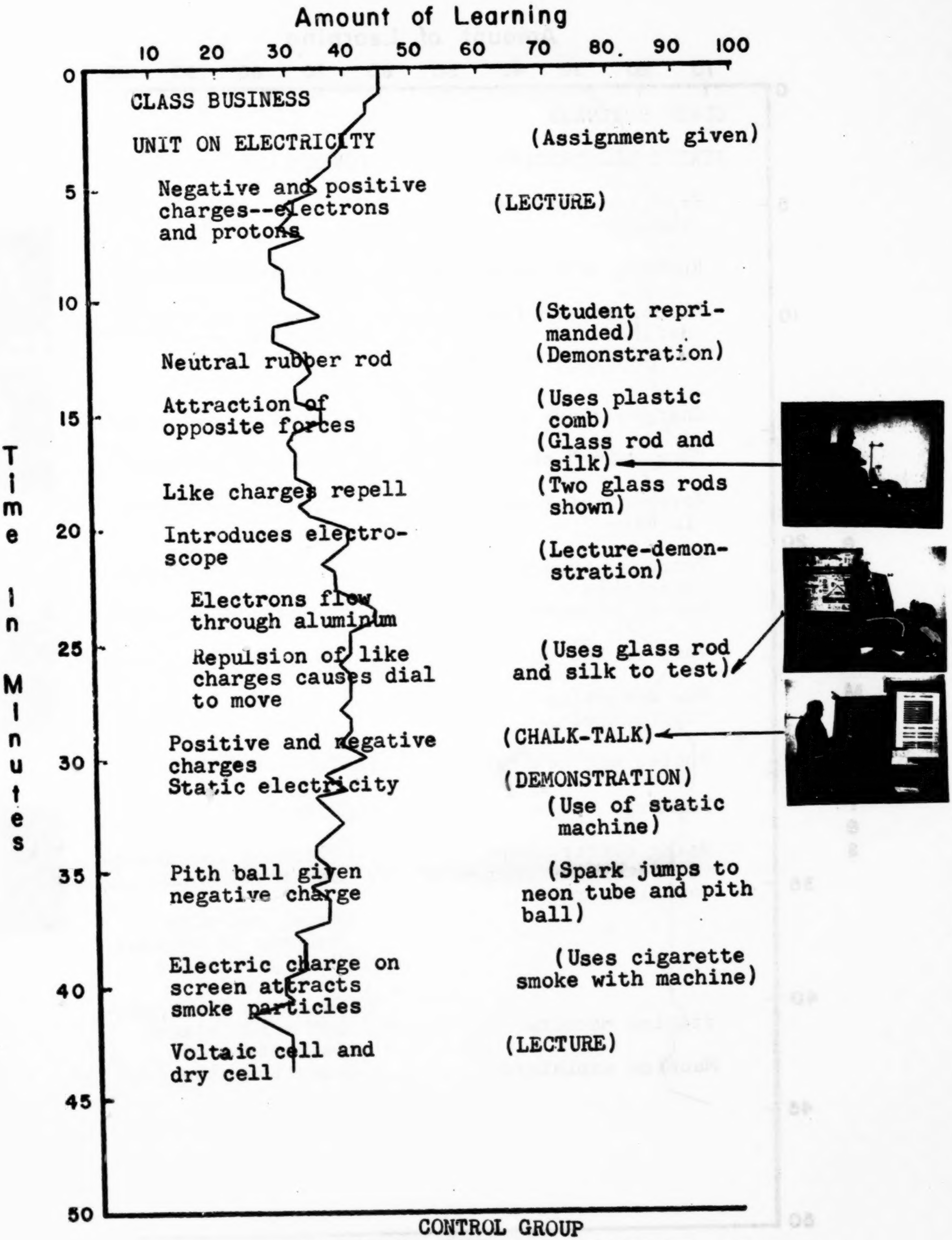
Another overhead transparency *** was a review and it was presented very briefly with little learning resulting (E168, 33).

---

* "Electrostatics", Encyclopedia Britannica Film, 1950, black and white, 10 min.

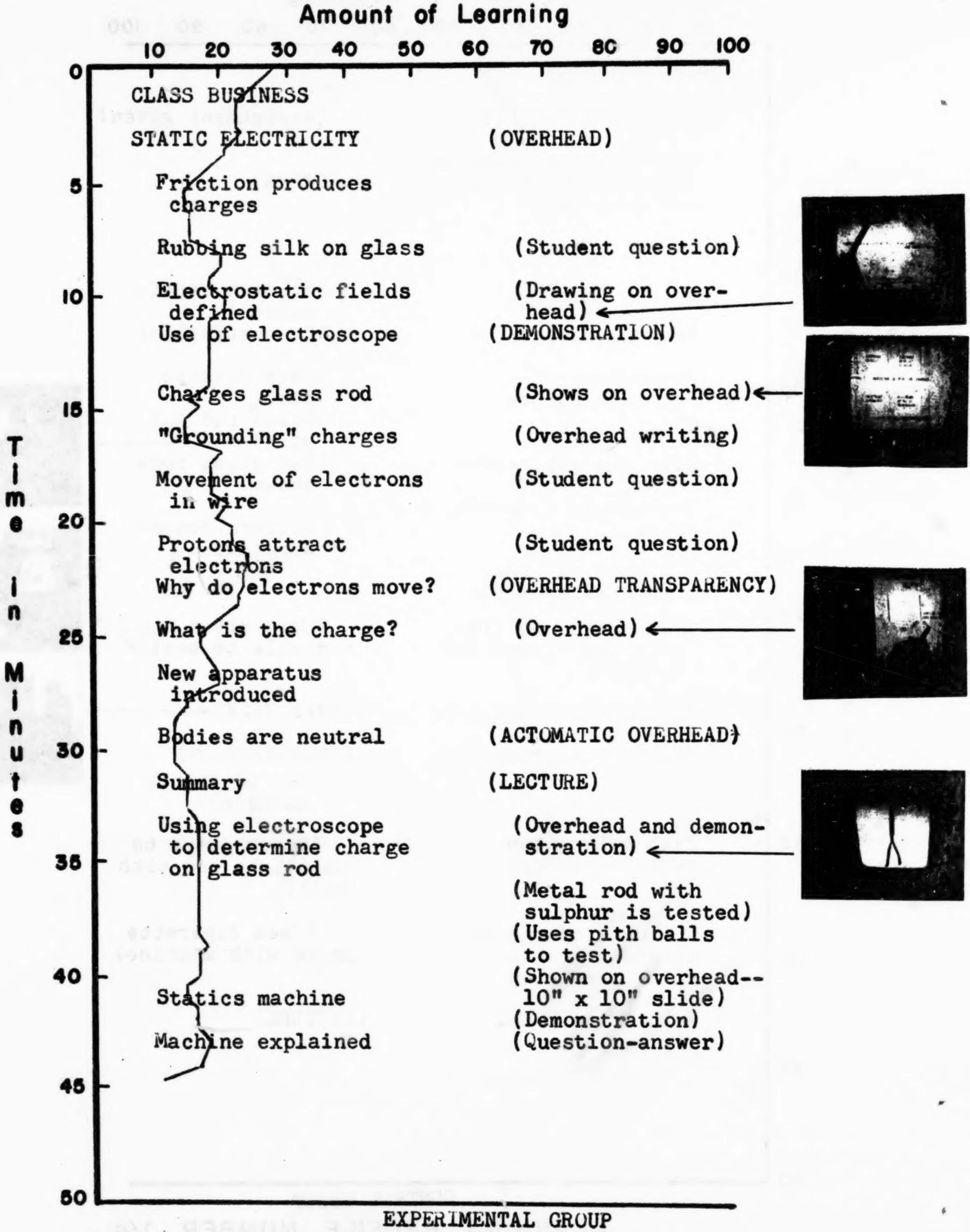
** "Static Electricity", Transparency IX.C., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.

*** "Electric Charges", Transparency IX. B., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.



CONTROL GROUP

LEARNING PROFILE NUMBER 169



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 170

ANALYSIS OF LEARNING PROFILE 169 and 170

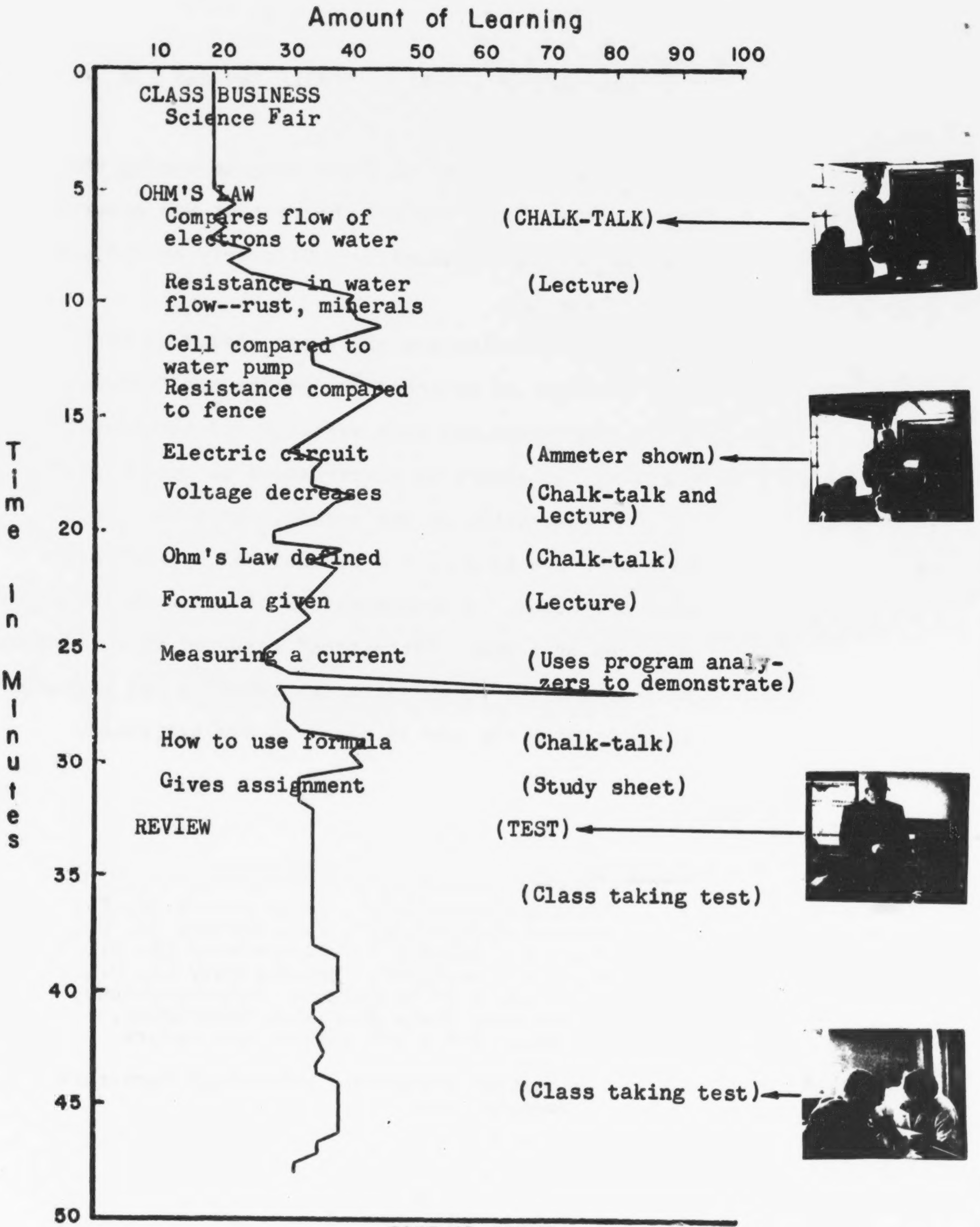
Learning reached no great heights during the Experimental Group because the content was generally the same as that studied by a filmstrip on the previous class day.

Overhead transparencies were used,* as well as a new type of overhead projector, the "Actomatic"** which makes possible both vertical and horizontal projection. It showed an electroscope in action (E170, 32, for instance), on the screen. This would not have been possible with a traditional type of overhead projector. A demonstration of static electricity produced by a small "Atomatron" resulted in a decrease in learning (E170, 40) although learning did increase slightly when the way it operates was explained.

---

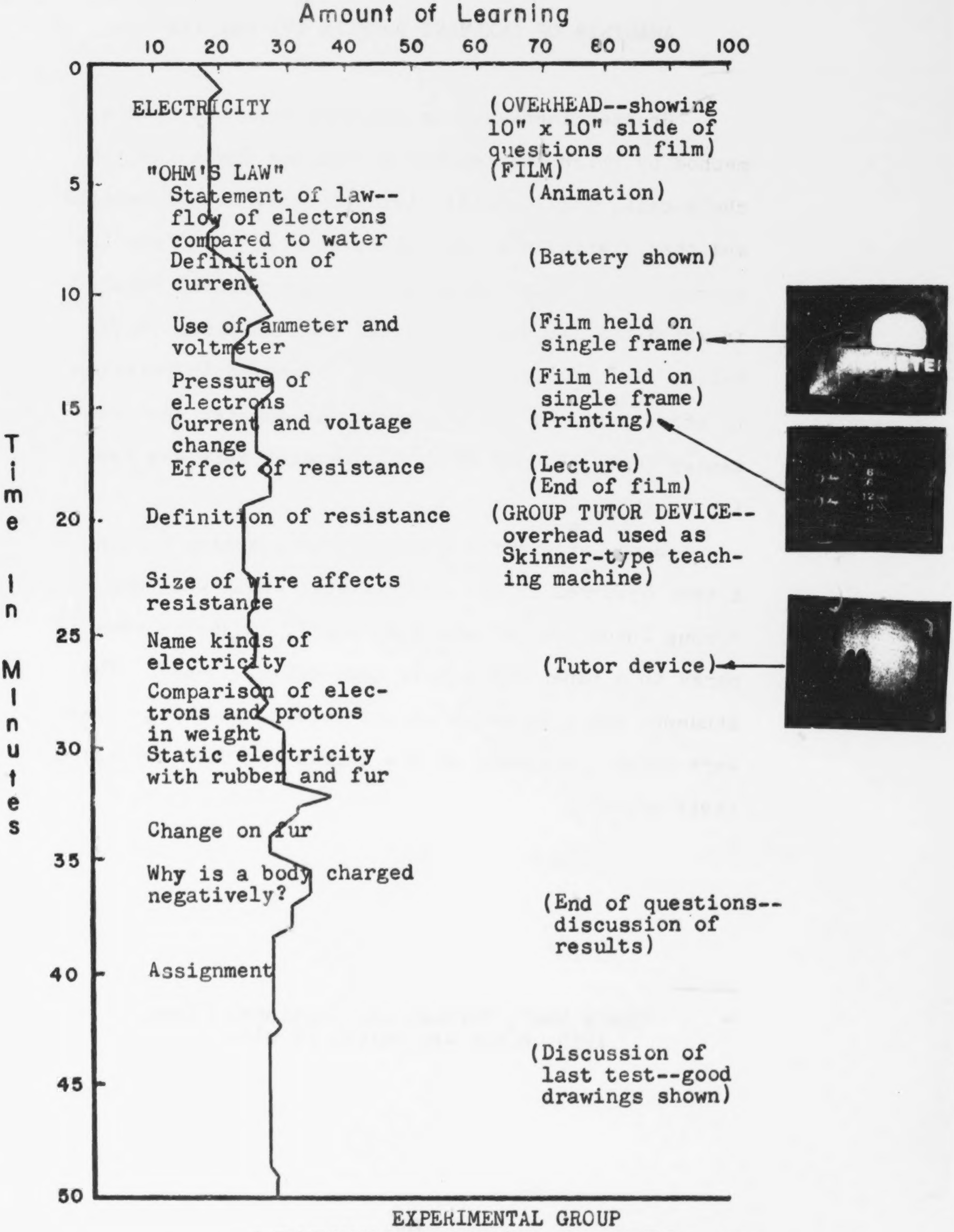
* "Static Electricity", Transparency IX. F.,
"Static Electricity", Transparency IX. C.,
"Electric Charges ", Transparency IX. B.,
"Electric Charges", Transparency IX. D.,
Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slides, two colors.

** "Actomatic" Projector, Laboratory Furniture Company, Inc.



CONTROL GROUP

LEARNING PROFILE NUMBER 171



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 172

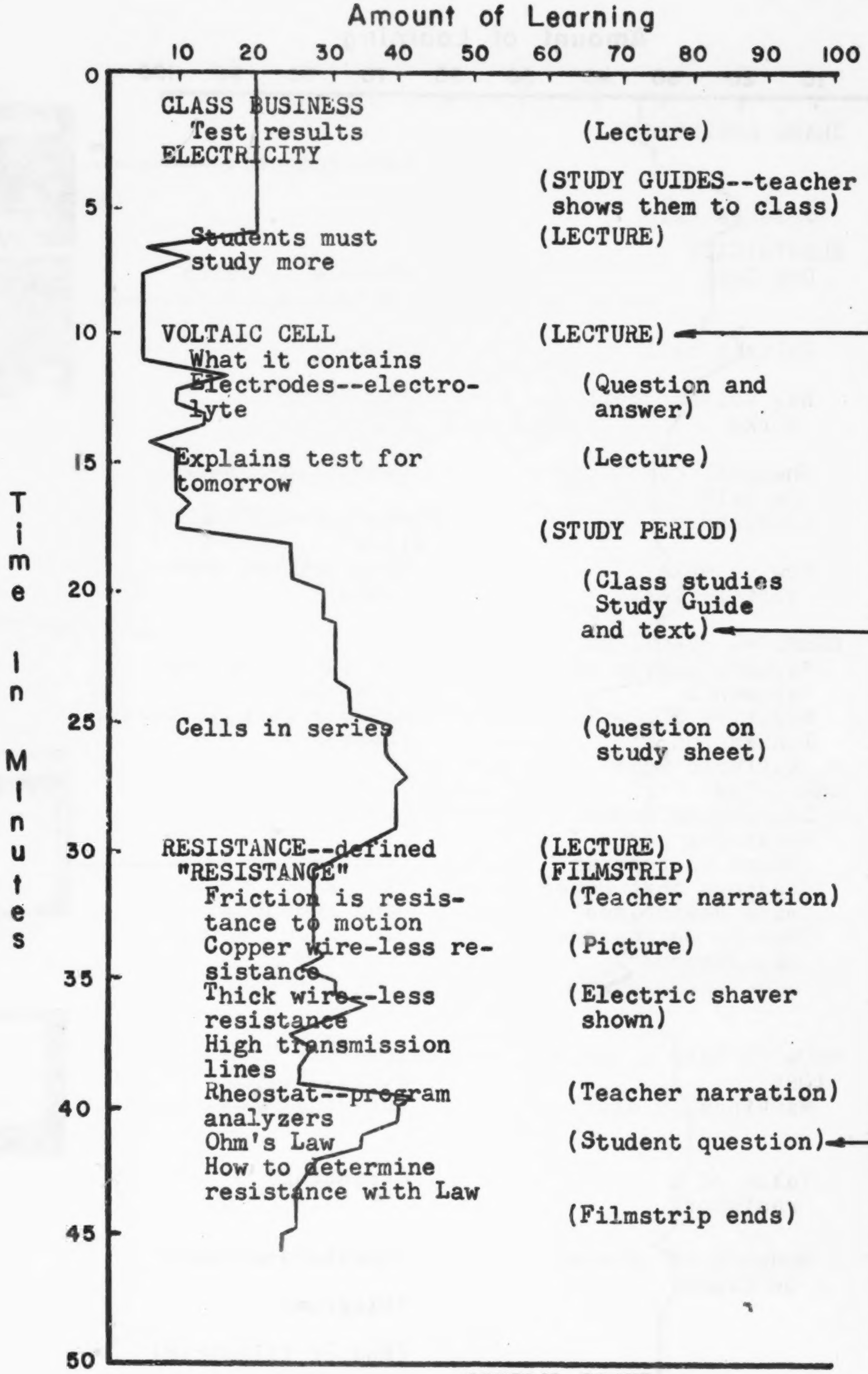
ANALYSIS OF LEARNING PROFILE 171 and 172

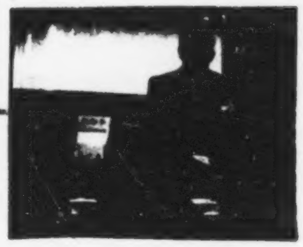
Greater increases in learning resulted from a method by which the teacher approached Ohm's law with chalk-talk, (C171, 6-18) giving background information and then stating the law (C171, 21-22), than from the approach of a film* shown in the Experimental Group in which the law was stated and then explained (E172, 5-17). In both groups learning decreased in relation to other parts of the class when an ammeter was presented (C171, 17 and E172, 12) because this was familiar to them.

Somewhat greater increases in learning during a test occurred in the Experimental Group when the "Group Tutor Device" was used (E171, 20-36) as compared to a paper and pencil test (E171, 33-47). The students saw a question on the screen, wrote an answer, were shown the answer on the screen and then corrected their answers.

---

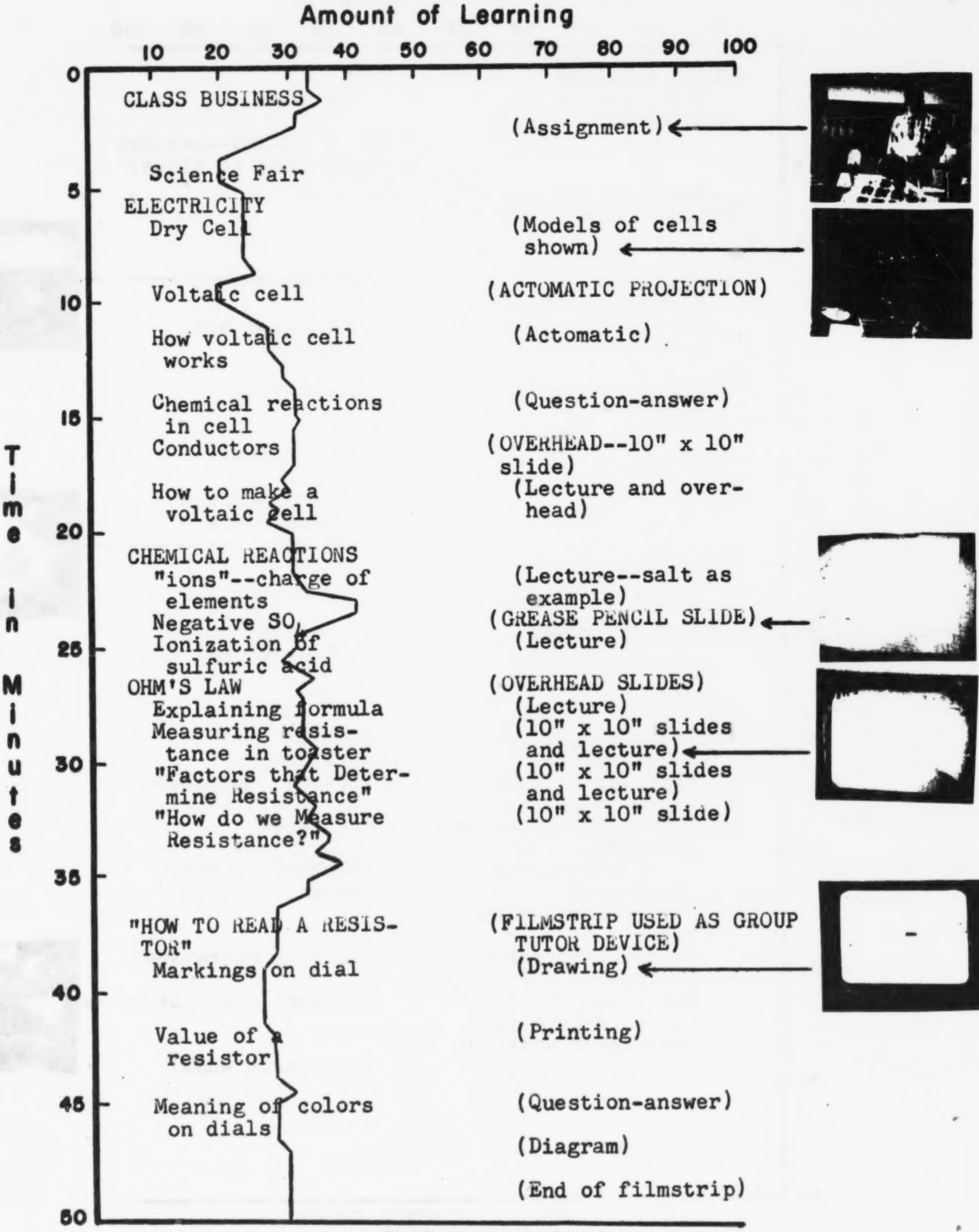
* "Ohm's Law", Coronet Instructional Films, 1955, black and white, 15 min.





CONTROL GROUP

LEARNING PROFILE NUMBER 173



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 174

ANALYSIS OF LEARNING PROFILES 173 AND 174

A voltaic cell presentation led to greater learning in the Experimental Group by being projected on the Actomatic overhead (E 174, 10-15, as compared with C 173, 10-13). Student interest was stimulated to result in the asking of a significant question.

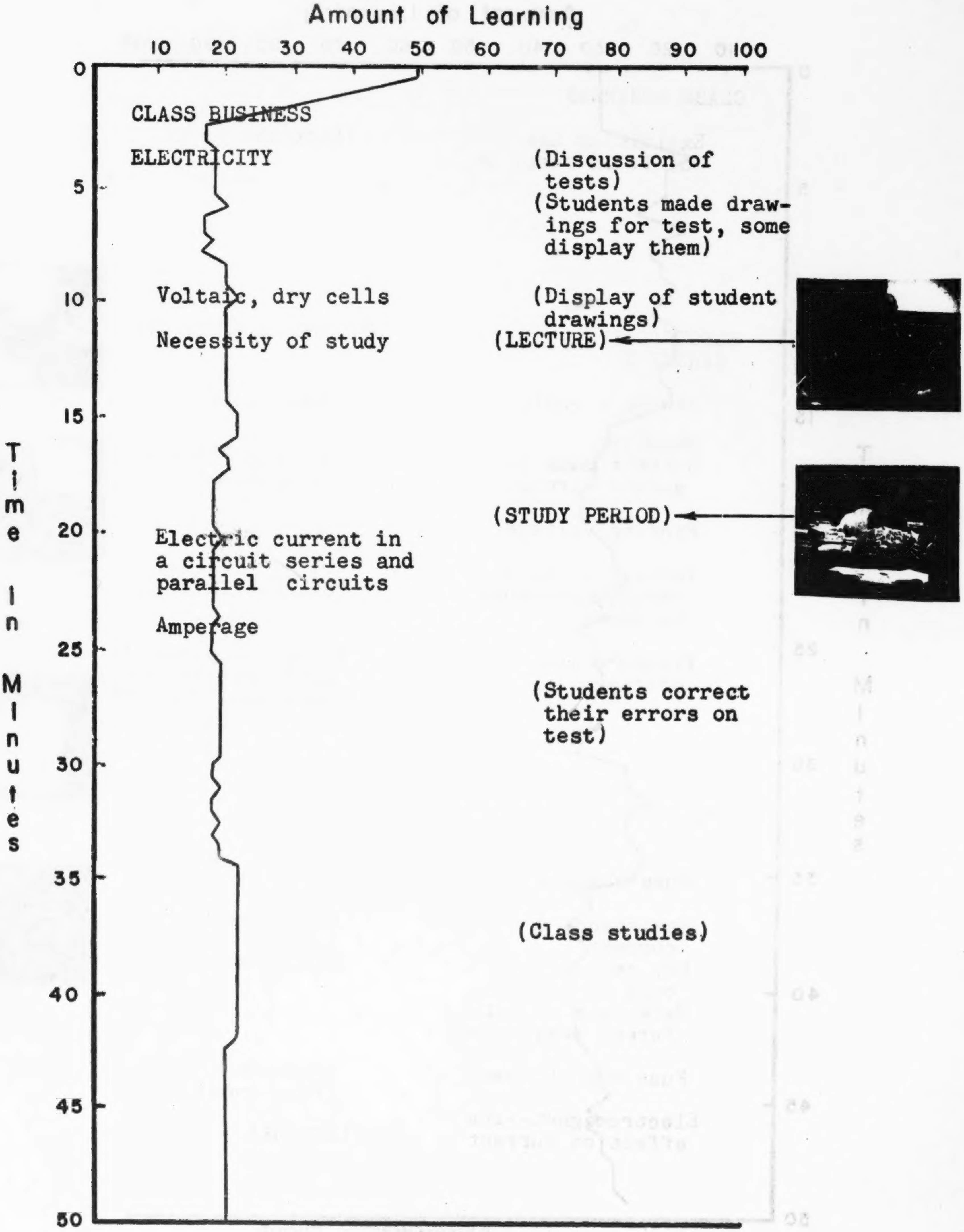
A filmstrip* on resistance led to approximately the same amount of learning in the Control Group (C 173, 30-44) as in the Experimental Group where overhead slides were used** rather rapidly (E 174, 27-34) and a filmstrip*** was quickly presented as a "Group Tutor Device". The filmstrip was prepared for demonstrating programmed learning to groups. The students indicated by overt comments that the filmstrip was very simple. However, they did know more about reading resistors after the filmstrip than they did before. The students may have confueed the simplicity of the process of learning with the content. The filmstrip may have been more useful to the students had an explanatory introduction of the procedure of taking up the information by small steps been presented. Low learning resulted because many students were not following directions and were not writing and checking their answers.

---

* "Resistance", Long Filmslide Service, n.d. Black and white, 27 frames.

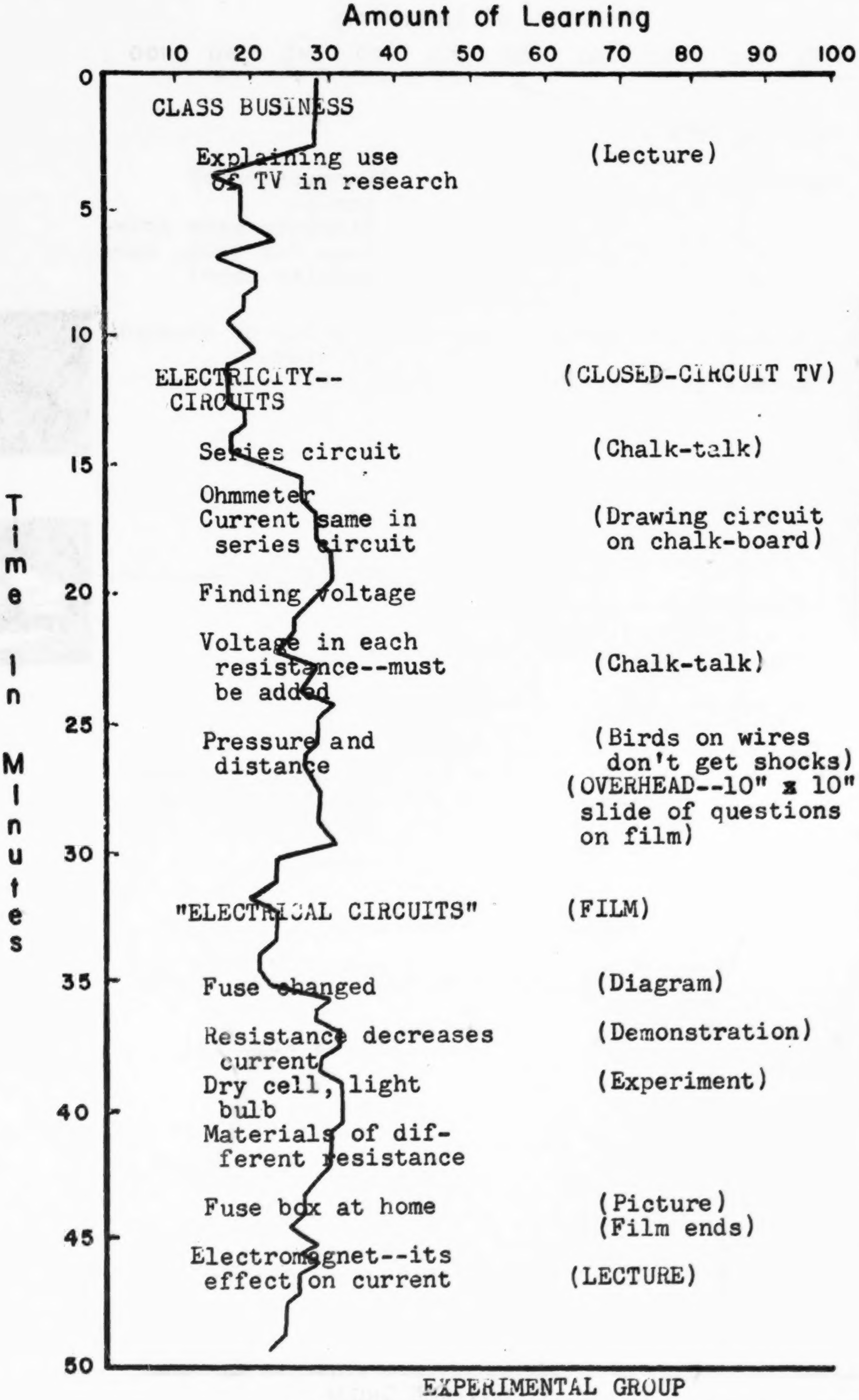
** "Ohm's Law", Transparency IX. W., Division of Educational Communications, New York State Education Department, 1961. Three part overlay, 10" x 10" slide, black and white.
"Factors that Determine Resistance", Transparency IX. X., same source as above. 10" x 10" slide, two colors.
"How Do We Measure Resistance?", Transparency IX. V., same source. 10" x 10" slide, two colors.

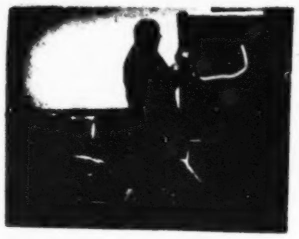
*** "How to Read a Resistor", Basic Skill Films, 1958. Color, 21 frames.

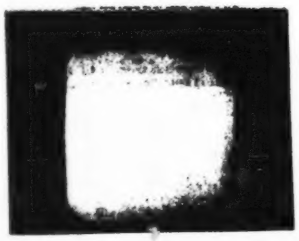


CONTROL GROUP

LEARNING PROFILE NUMBER 175







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 176

ANALYSIS OF LEARNING PROFILES 175 AND 176

Greater learning resulted from the use of a variety of media in the Experimental Group than from discussion of tests, lecture, or individual study in the Control Group.

In the Experimental Group closed circuit television was used to enlarge the view of a meter and to feature certain parts of a demonstration. The motion picture* resulted in effective learning. The students were looking for answers to questions (about the film) which were projected on a separate screen by an overhead projector.

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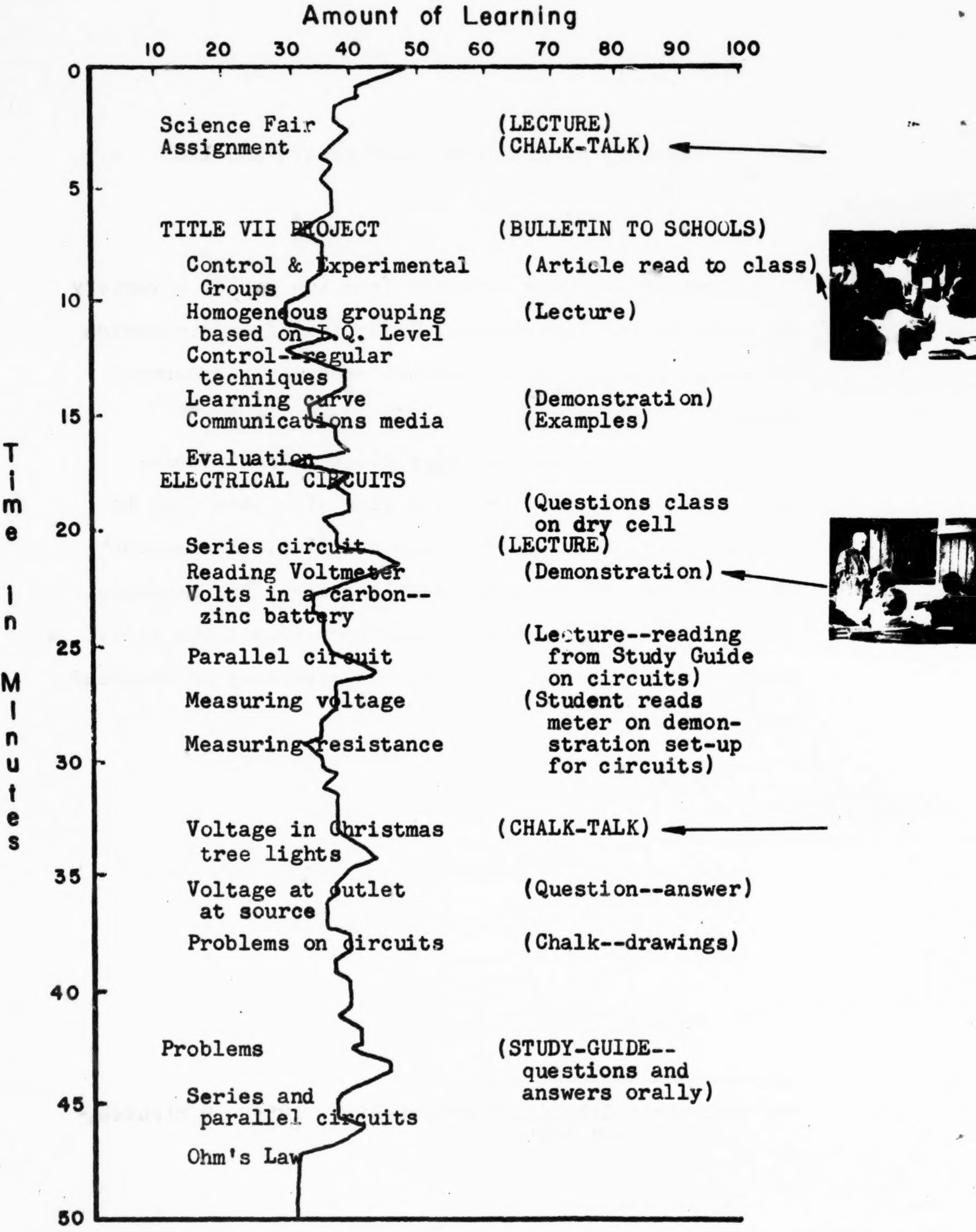
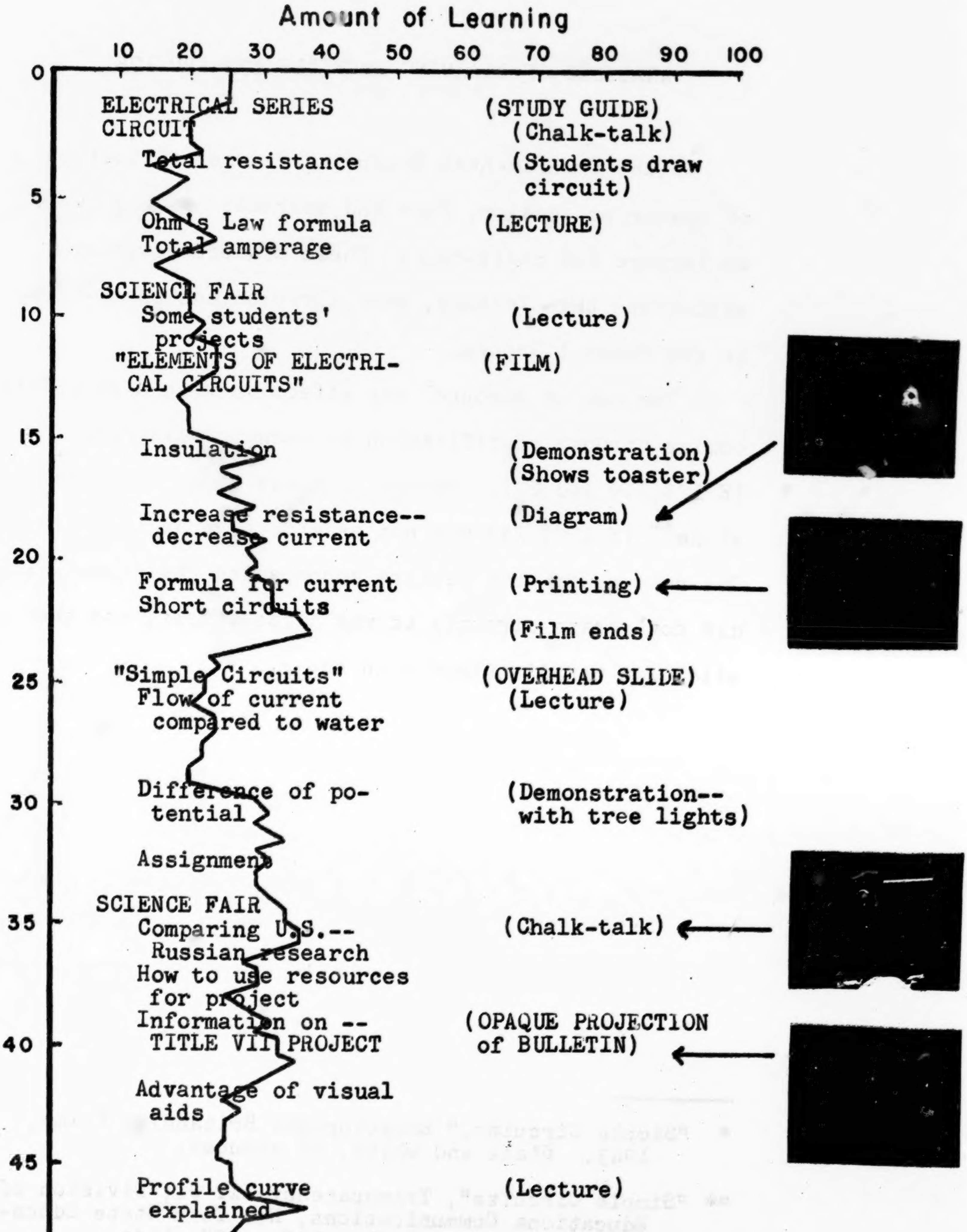
* "Electric Circuits," McGraw-Hill, 1955. 9 minutes, black and white.



LEARNING PROFILE NUMBER 177



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 178

ANALYSIS OF LEARNING PROFILES 177 AND 178

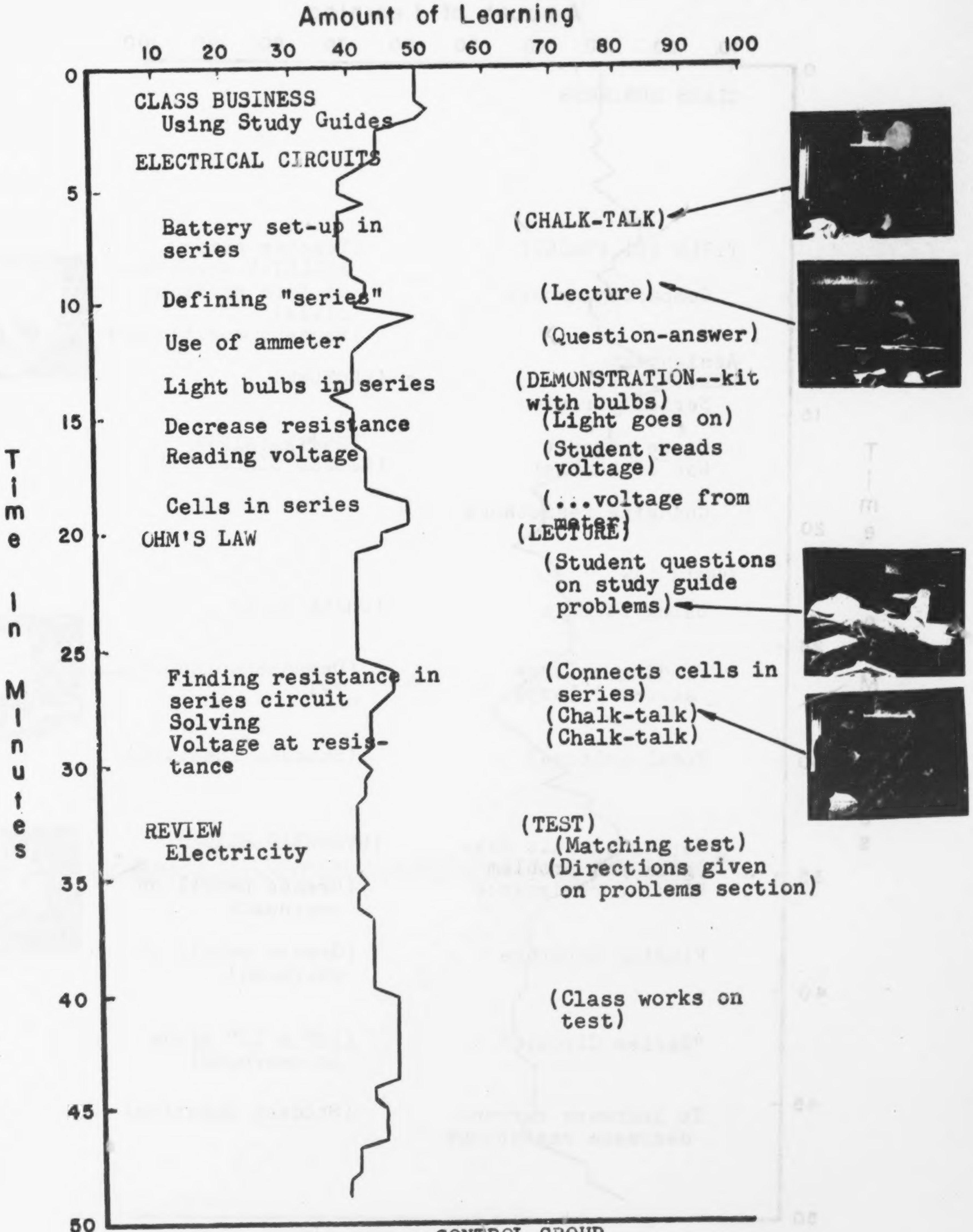
In the Experimental Group, there was utilization of opaque projection, film and onerhead slide as well as lecture and chalk-talk. These produced greater variations than lecture, demonstration and chalk-talk in the Control Groups.

The motion picture* was effective with high points coming through clarification by means of diagrams (E 178, 19 and 23). Review of means of an overhead slide** (E 178, 25) was not as effective as the film. One reason was that lecture accompanied the slide which did not relate directly to the slide itself, and the slide was not discussed with the class.

---

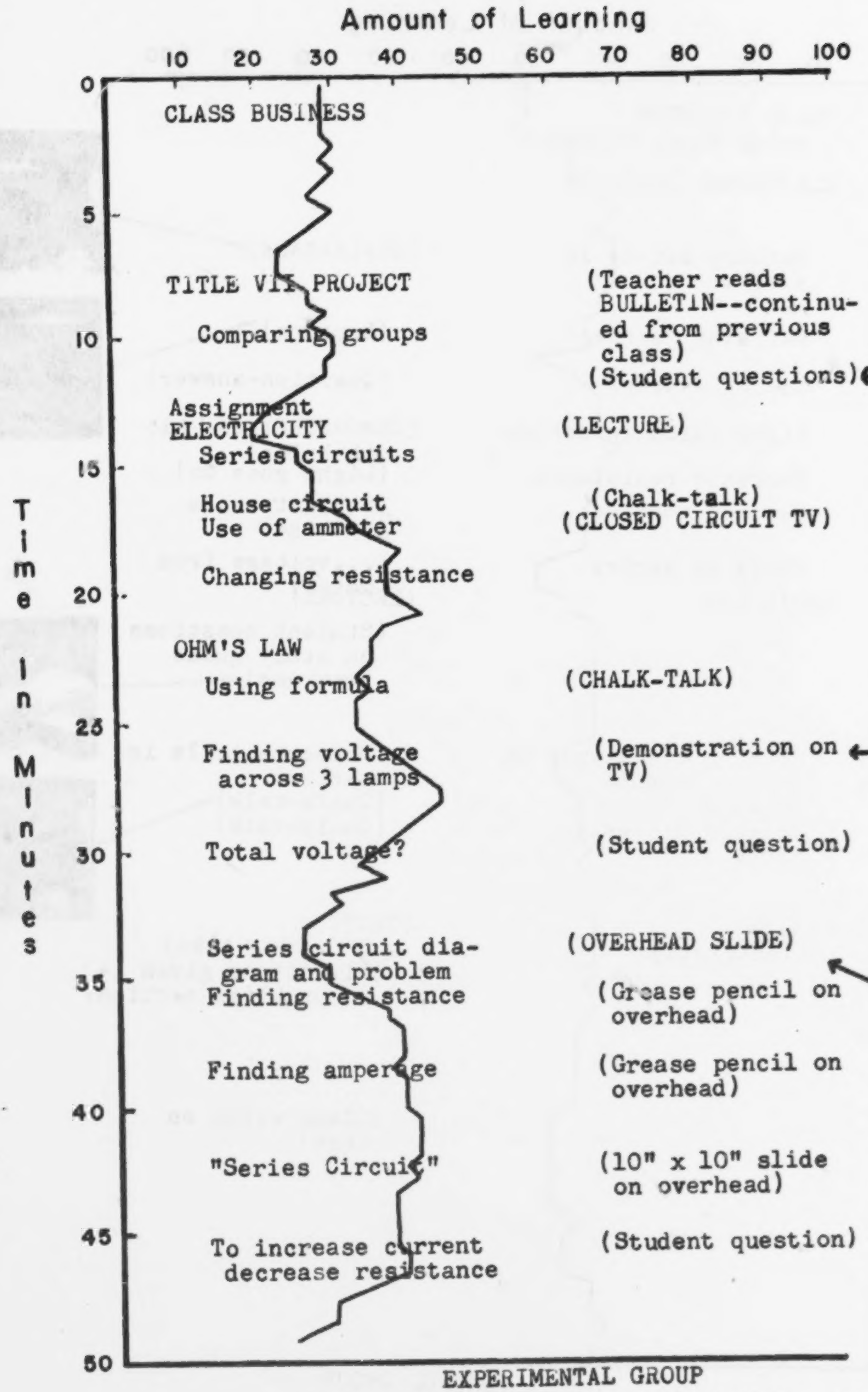
* "Simple Circuits," Encyclopedia Britannica Films, 1943. Black and white, 10 minutes.

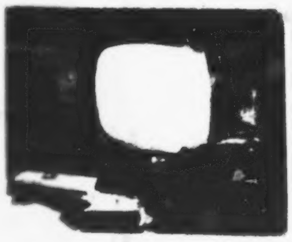
** "Simple Circuits", Transparency IX. J., Division of Educationa Communications, New York State Education Department, 1961. 10" x 10" slide.

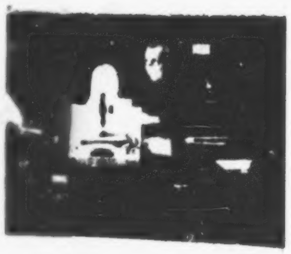


CONTROL GROUP

LEARNING PROFILE NUMBER 179







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 180

ANALYSIS OF LEARNING PROFILES 179 and 180

Greater learning resulted in the Experimental Group with the use of closed-circuit television for enlargement of a meter used as part of a demonstration (E180, 17-21 and 25-30). Whereas discussion of the use of the ammeter led to a drop in learning in the Control Group (C179, 12), demonstration of it with television led to an increase in learning in the Experimental Group (E 180, 18).

During the class the teacher drew a slide for the overhead with a grease pencil and then projected it (E180, 33-41) making additions as part of his presentation. Learning was effective here and during the use of an overhead slide* prepared by diazo processes to which the teacher also made additions (E180, 43-47). The latter slide stimulated student interest as indicated by a question.

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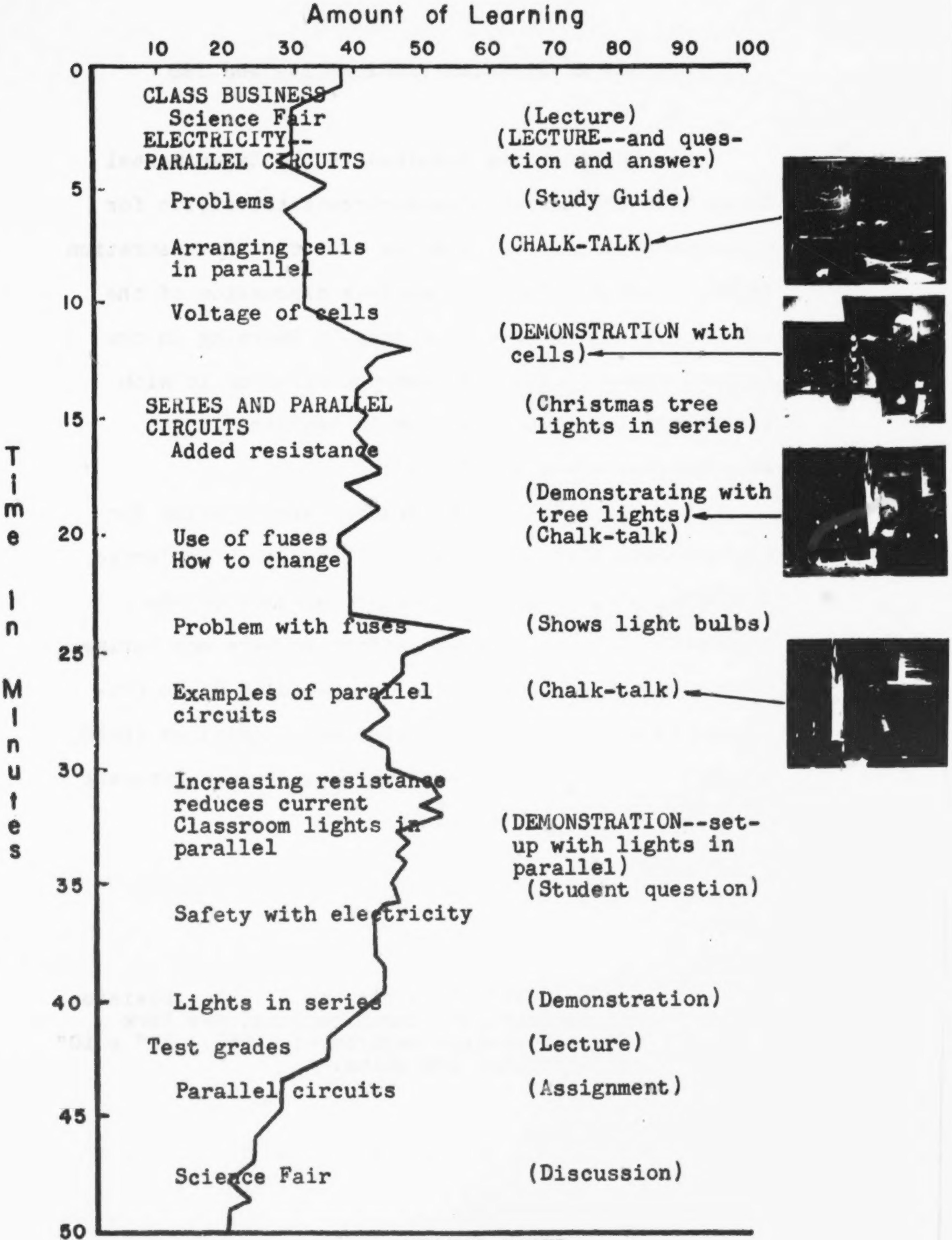
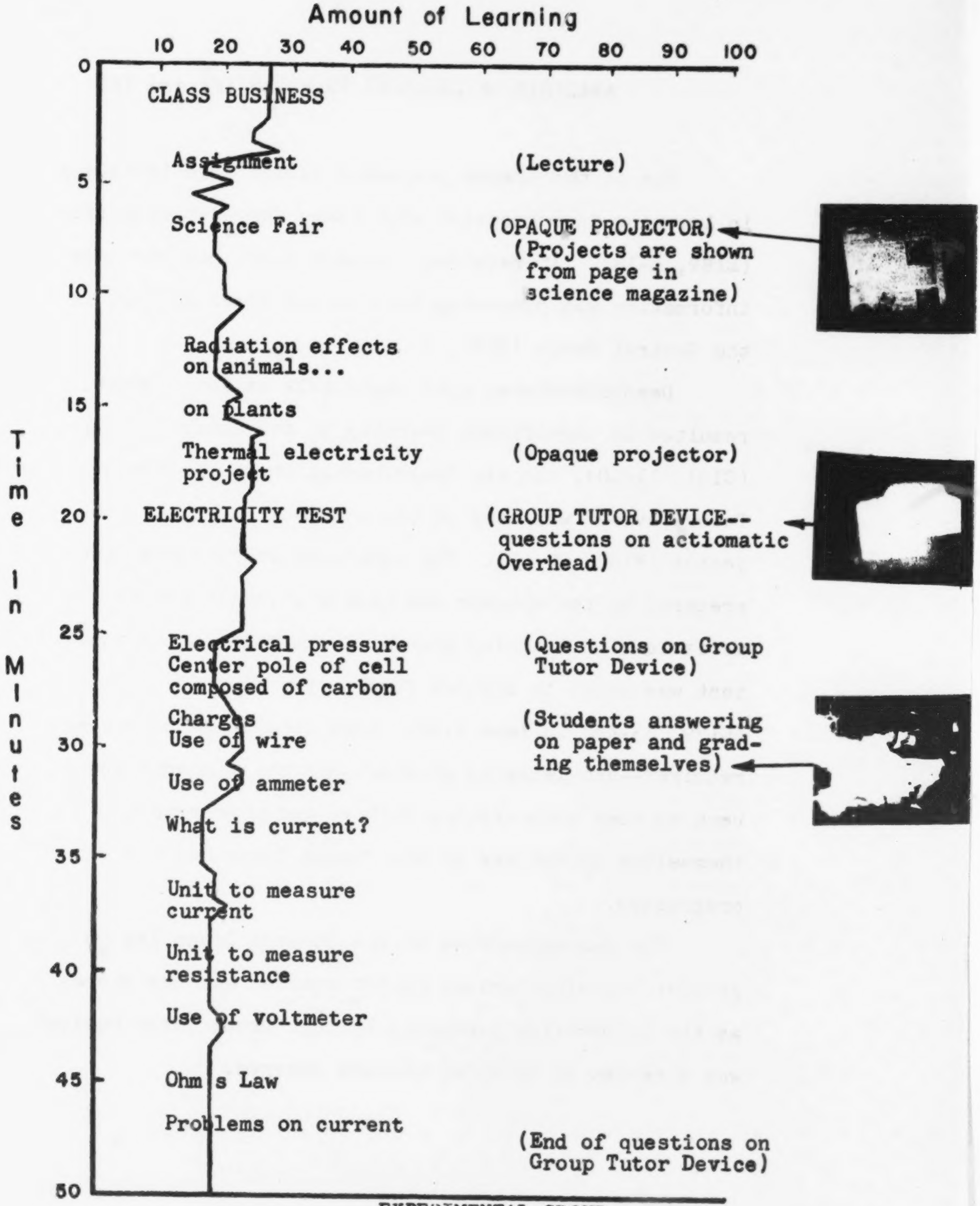
* "Series Circuit", Transparency IX. LL., Division of Educational Communications, New York State Education Department, 1961. 10" x 10" slide, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 181



EXPERIMENTAL GROUP

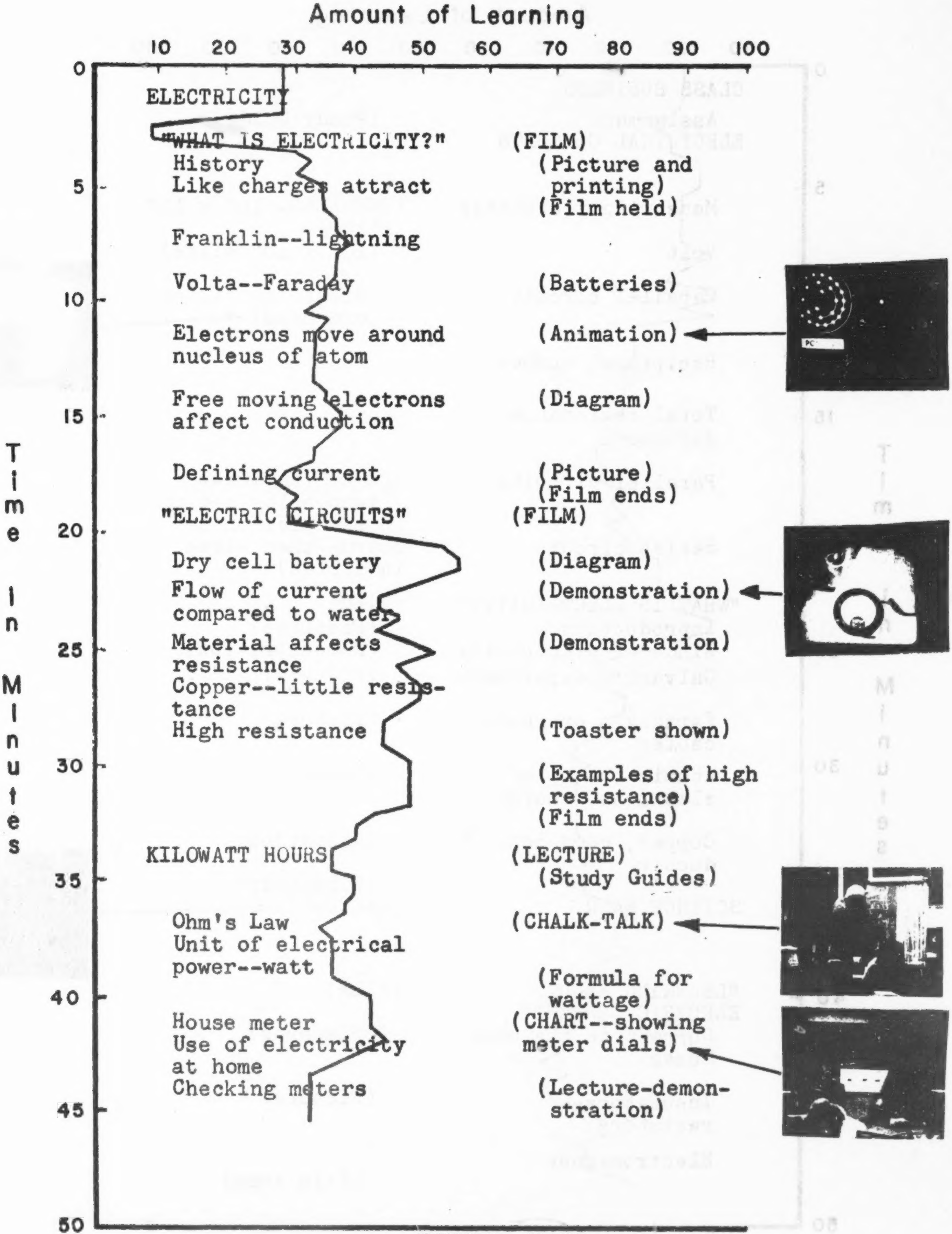
LEARNING PROFILE NUMBER 182

ANALYSIS OF LEARNING PROFILES 181 and 182

Use of the opaque projector caused some increases in learning in connection with ideas for a science fair (E182, 6-18). It required a longer time; however more information was presented than in the brief lecture in the Control Group (C181, 2).

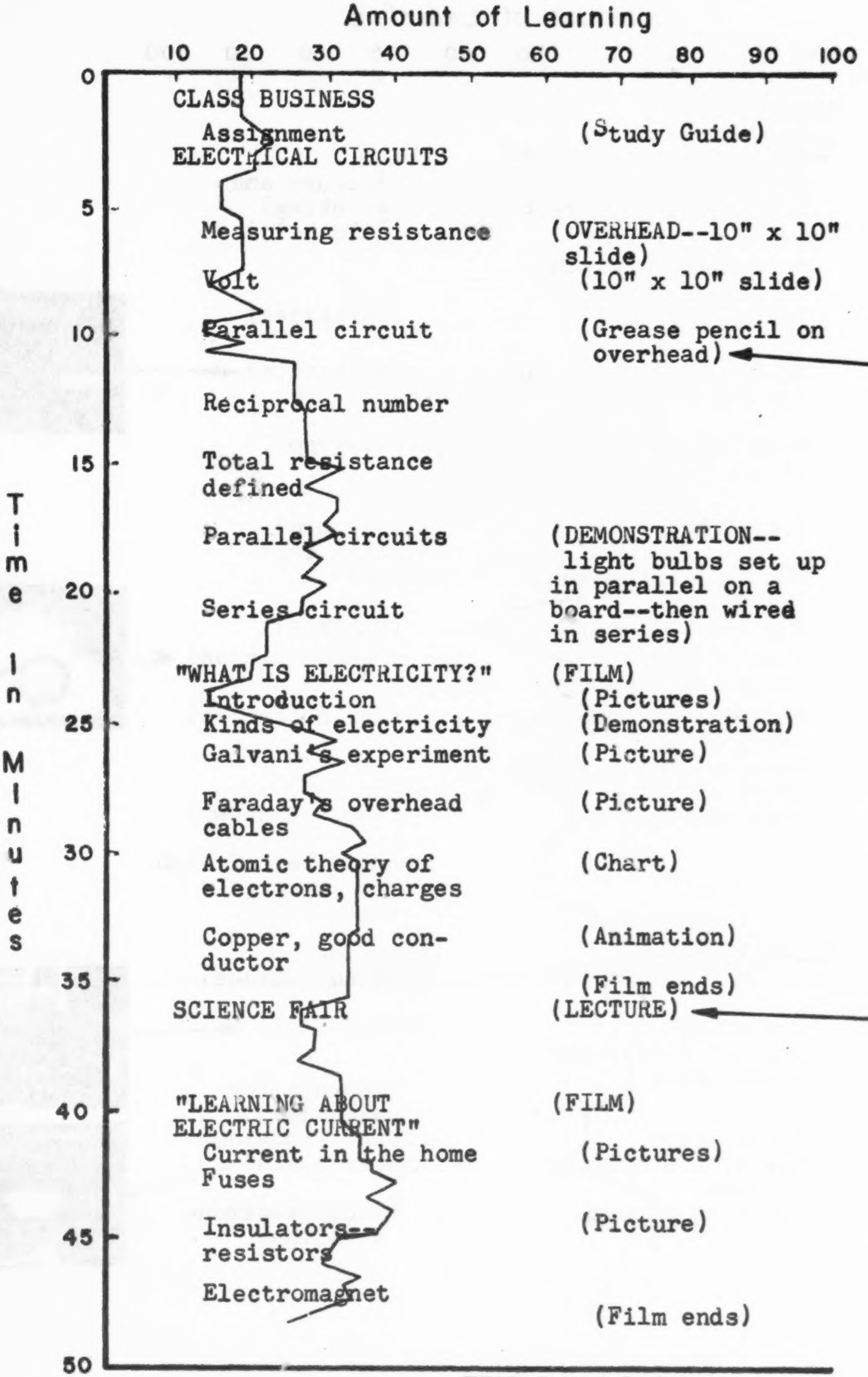
Demonstrations, with chalk-talk at some points, resulted in significant learning in the Control Group (C181, 11-40). In the Experimental Group the "Group Tutor Device" was used on the Actomatic overhead projector (E182, 20-47). The questions and answers were prepared by the teacher and caused slightly greater variations in learning than when essentially the same test was given in dittoed form to the Control Group (C179, 33-48) in less time. Less time would have been required--and learning greater--had the students not been so busy both writing answers and then grading themselves as the use of the "Group Tutor Device" progressed.

The demonstrations in the Control Group led to greater learning because the information was new whereas the information presented by the "Group Tutor Device" was a review of material already covered.



CONTROL GROUP

LEARNING PROFILE NUMBER 183



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 184

ANALYSIS OF LEARNING PROFILES 183 and 184

As it was regularly a part of instruction, a film* was presented in the Control Group (C183, 20-32) and it yielded significant learning, although presented without introduction or questions to guide students in watching the film as had been the case when the film was presented to the Experimental Group (E176, 32-44). Less increases in learning in the latter case may have been due to the fact that part of the information provided by the film had been taken up earlier in the class session (E176, 12-32).

The fact that this topic (Circuits) was taken up a third time by the Experimental Group explains why there were only moderate increases in learning when overhead transparencies** were presented on the same topic again (E184, 5-16). Several were presented quite rapidly.

---

* "Electric Circuits", McGraw Hill Book Company, 1955. Black and White, 11 min.

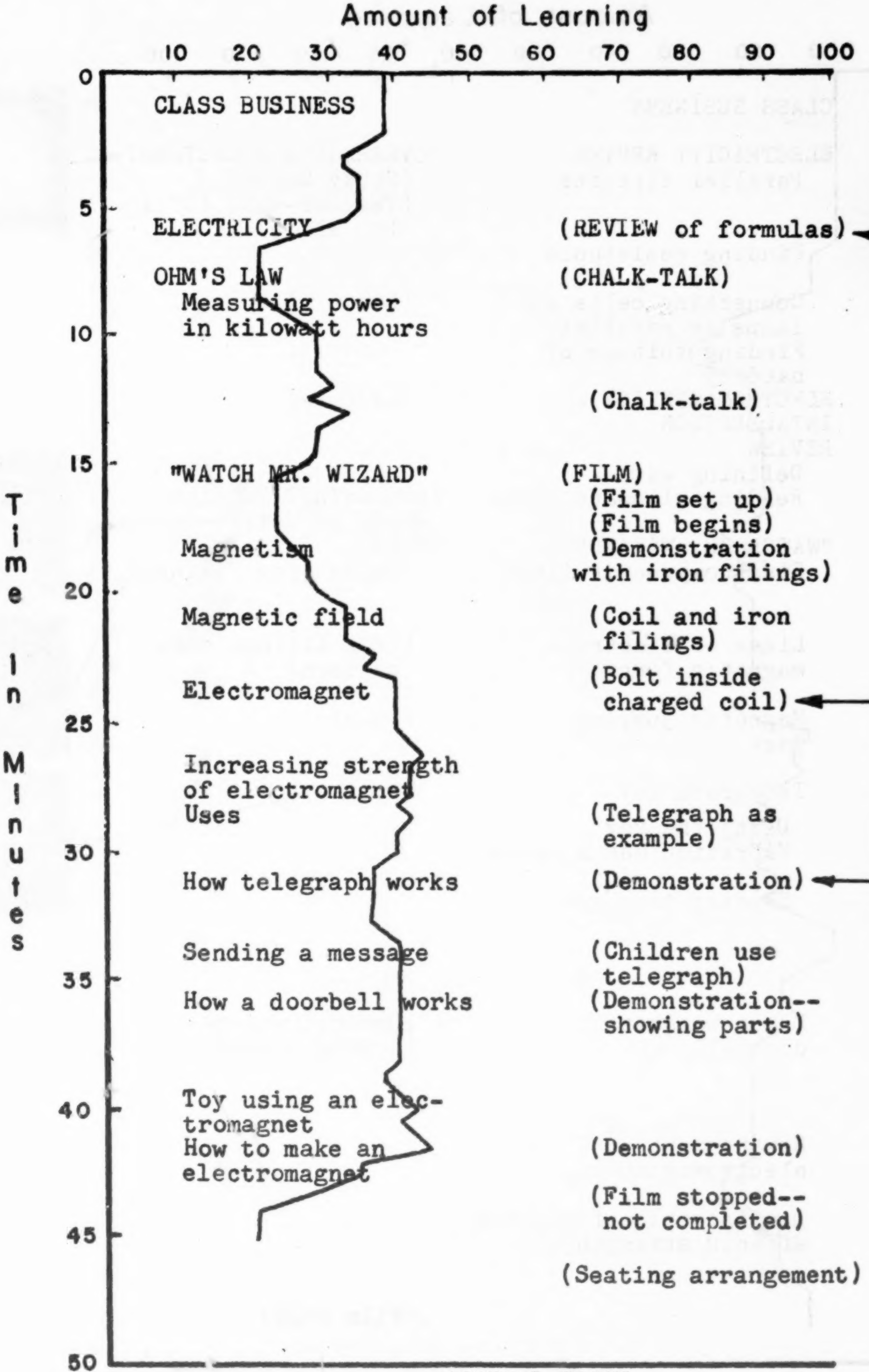
** "Measurement of Resistance", Transparency IX. M., Division of Educational Communications, New York State Education Department, 1961. 10" x 10" slide, black and white.

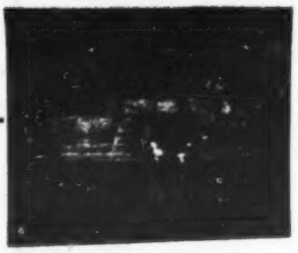
"Volt", Transparency IX. AA., same source as above, 1961. 10" x 10" slide, red and white.

"Electric Current", Transparency IX. HH., same source as above, 1961. 10" x 10" slide, three colors, two part overlay.

Another facet of the effect of repetition was indicated by a third showing in the Experimental Group of a film*** (E184, 23-35) which had been shown previously by two different approaches within one class period (E164, 4-20 and 22-41); and yet, learning still was as significant as that of the Control Group which saw the same film (C183, 3-18) as a regular part of instruction. The continued effectiveness of the film may be attributed to the large amount of carefully selected information contained in the film format.

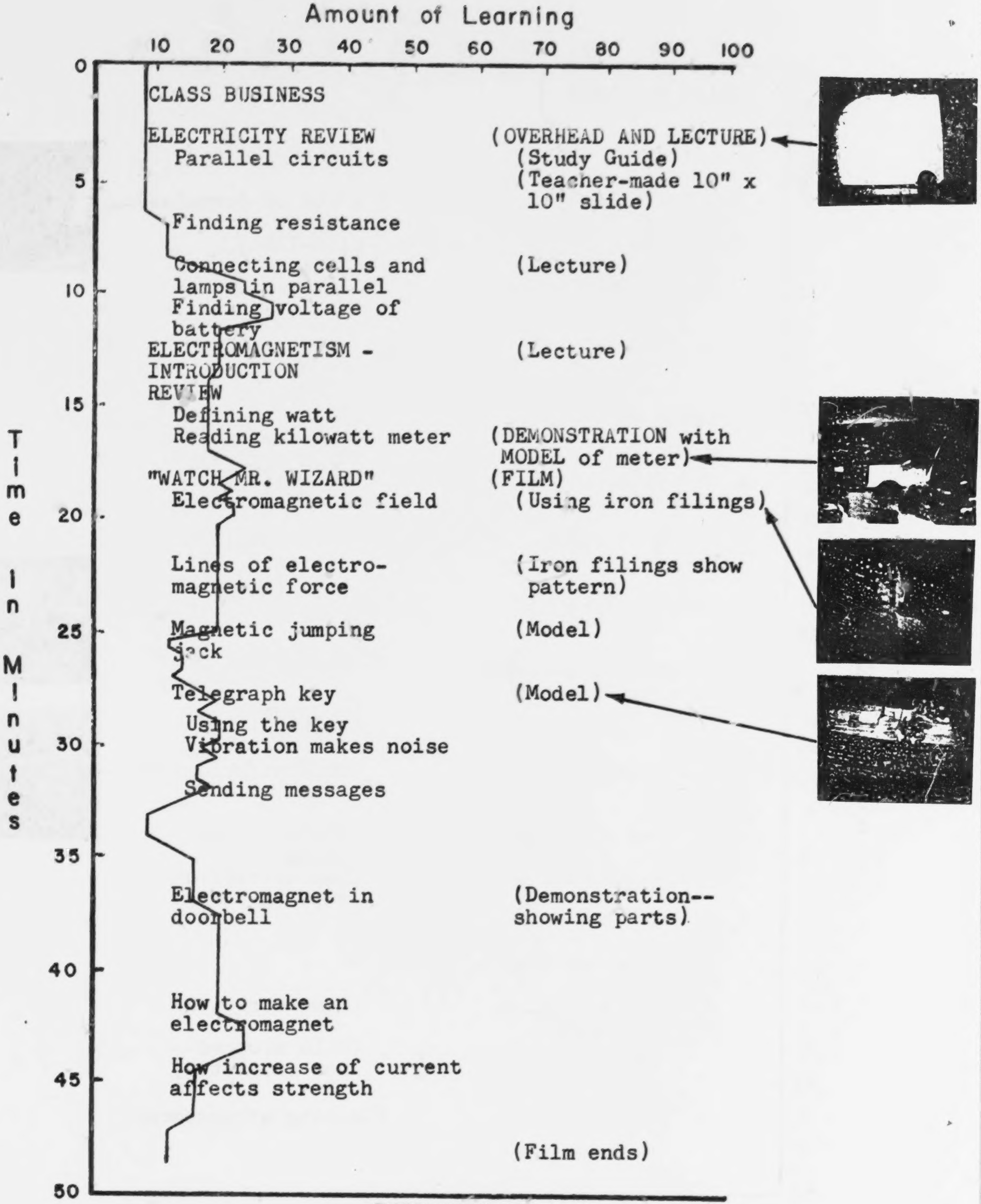
*** "What is Electricity", Encyclopaedia Britannica Films, 1953. Black and white, 15 min.





CONTROL GROUP

LEARNING PROFILE NUMBER 185



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 186

6

ANALYSIS OF LEARNING PROFILES 185 and 186

Use of the grease pencil on the overhead projector already done by the students (E186, 3-7) did not prove to be effective because the students already knew the information.

A film* was shown in the Control Group (C185, 15-44) because it was a regular part of instruction and led to some learning. When the two profiles are adjusted to take into consideration the higher beginning of the profile in the Control Group, the general amount of learning was approximately the same in both groups on a new topic, the electromagnet (C185, 40 and E186, 43).

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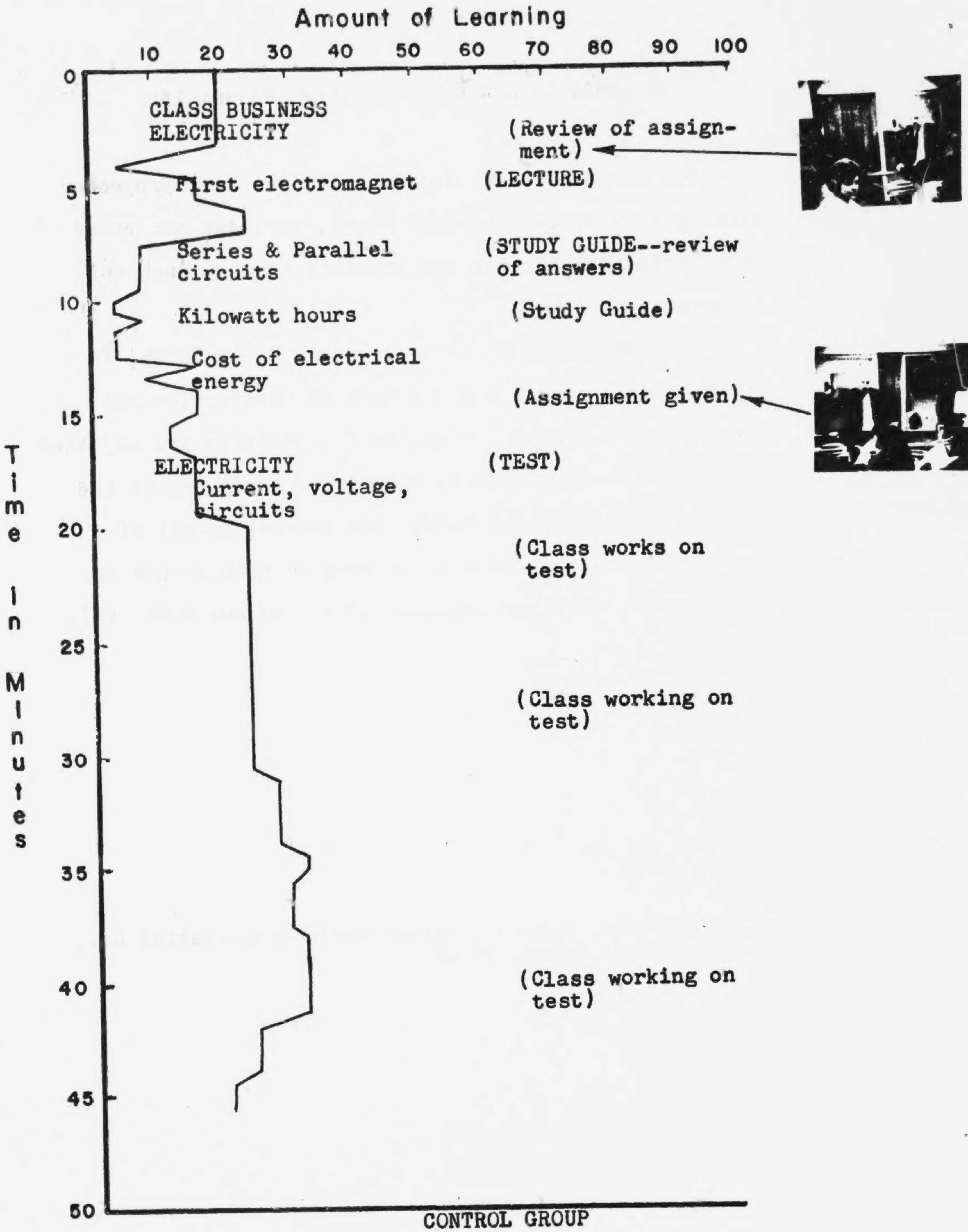
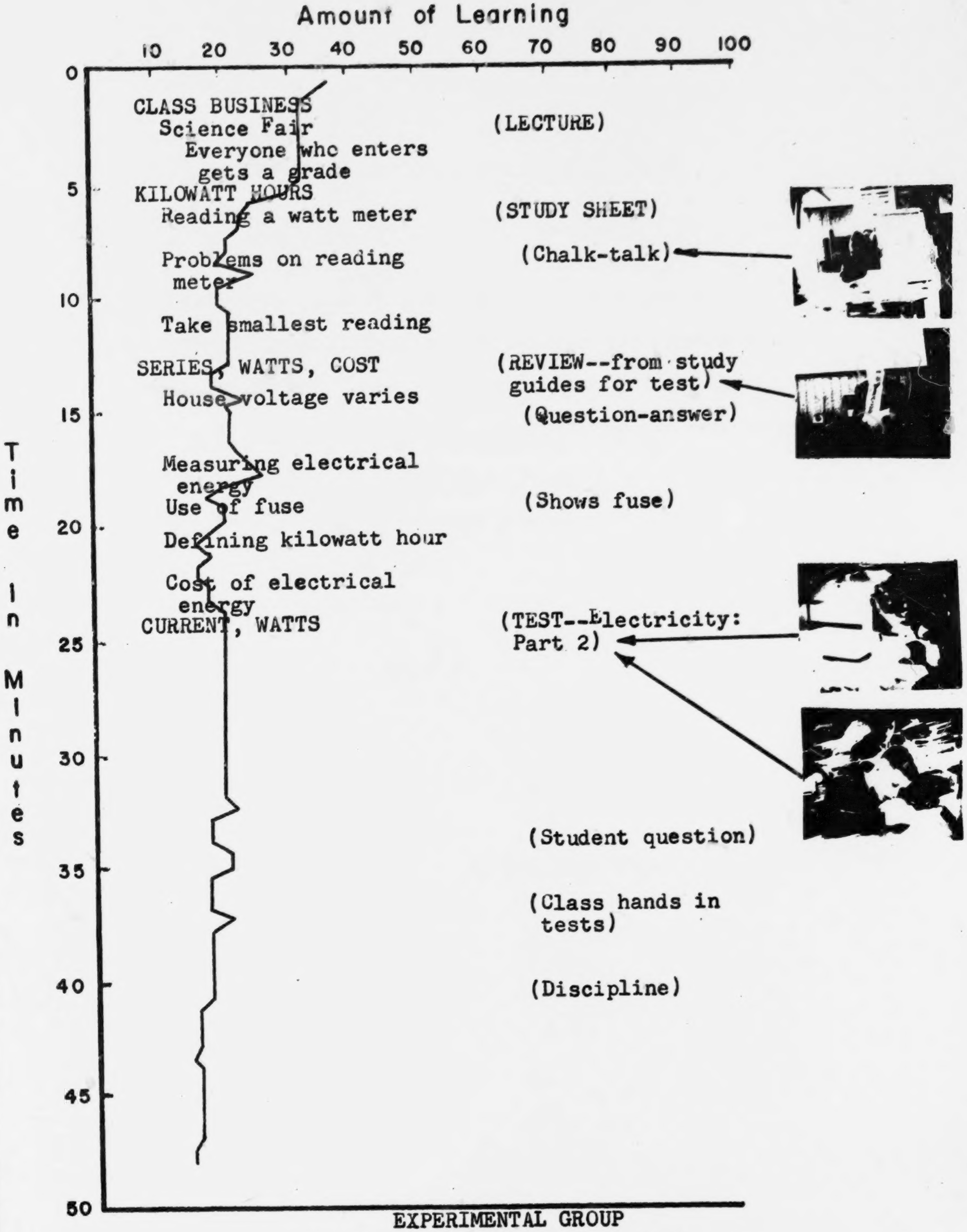
* Watch Mr. Wizard", United World Broadcasting Co., nd. Color, 29 min.



CONTROL GROUP

LEARNING PROFILE NUMBER 187

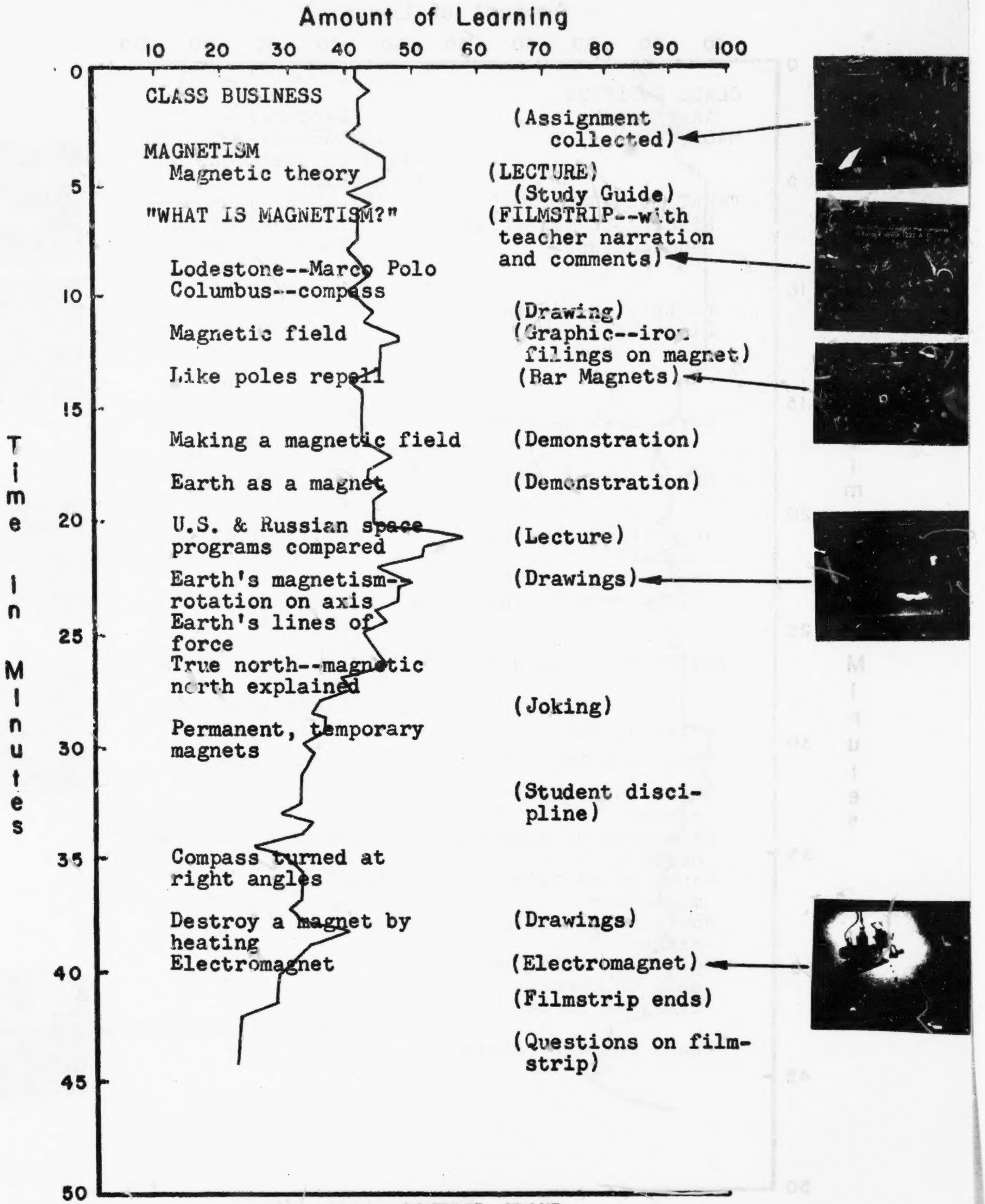


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 188

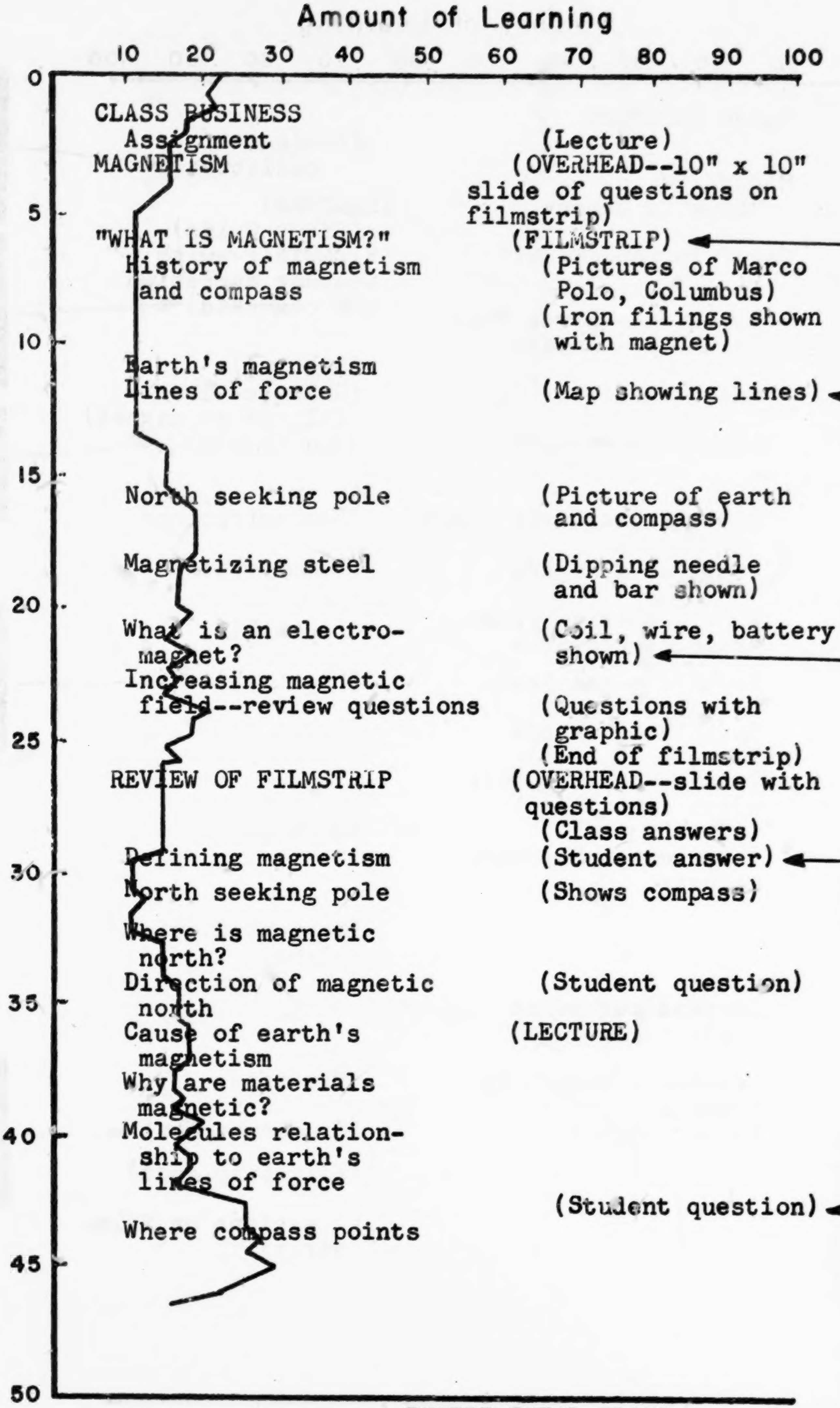
ANALYSIS OF LEARNING PROFILES 187 and 188

As was the usual pattern, review, group study and a test did not result in significant increases in learning during the class session. The test was one prepared by the teacher.



CONTROL GROUP

LEARNING PROFILE NUMBER 189



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 190

ANALYSIS OF LEARNING PROFILES 189 and 190

A filmstrip * was shown as a regular part of instruction in the Control Group (C189, 6-42). Learning was greater in the Control Group than in the Experimental Group which also viewed the filmstrip (E190, 7-25). Reasons for the difference were: the Control Group was given an introduction by means of an explanation of magnetic theory; the Control Group spent twice as much time on the filmstrip (36 minutes as compared with 18 minutes); the Control Group was seeking answers to a study sheet which was a required part of the course whereas the Experimental Group was involved in answering separate questions relating directly to the filmstrip only; the teacher reminded the Control Group only to take out their program analyzer dials (C189, 5½)

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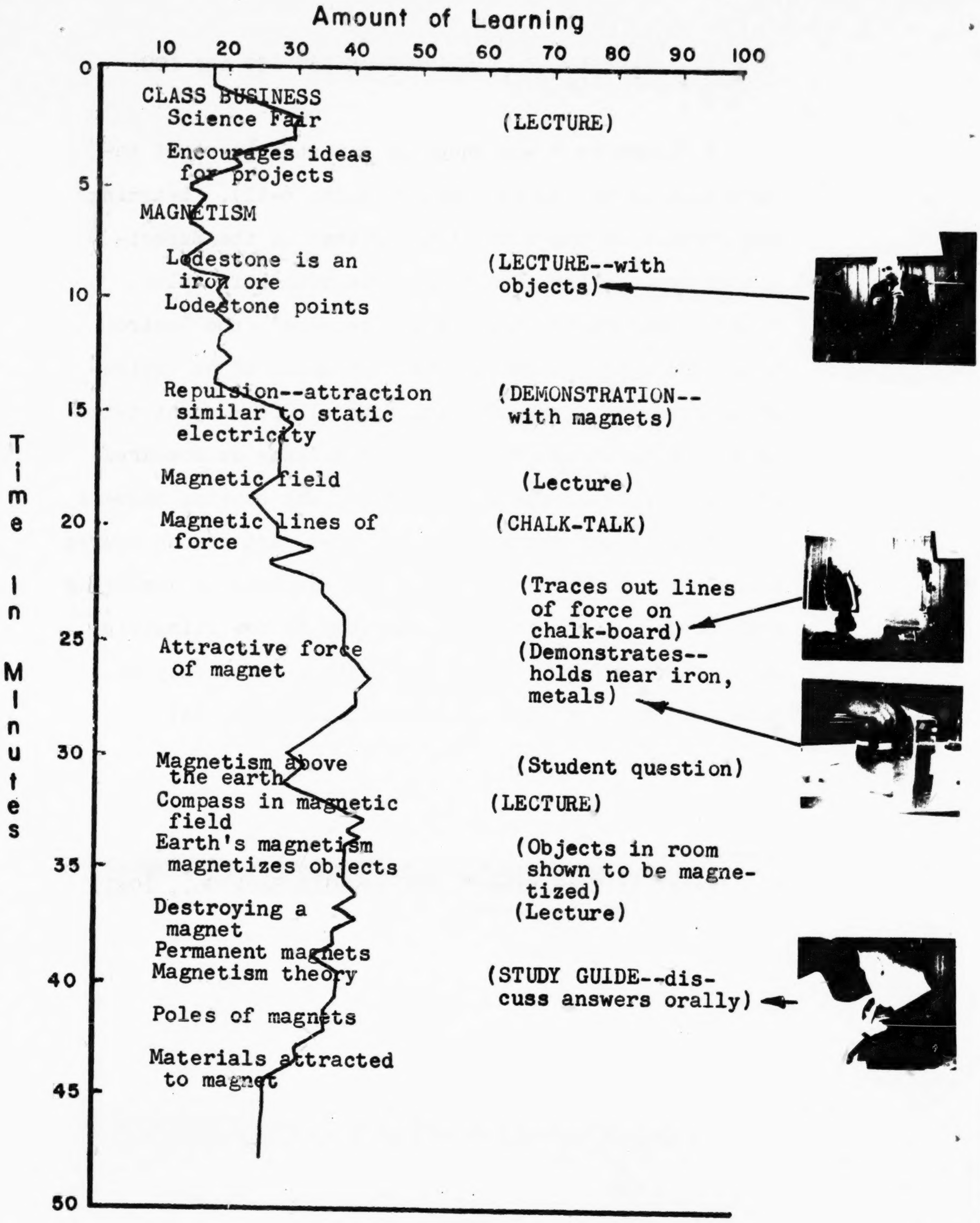
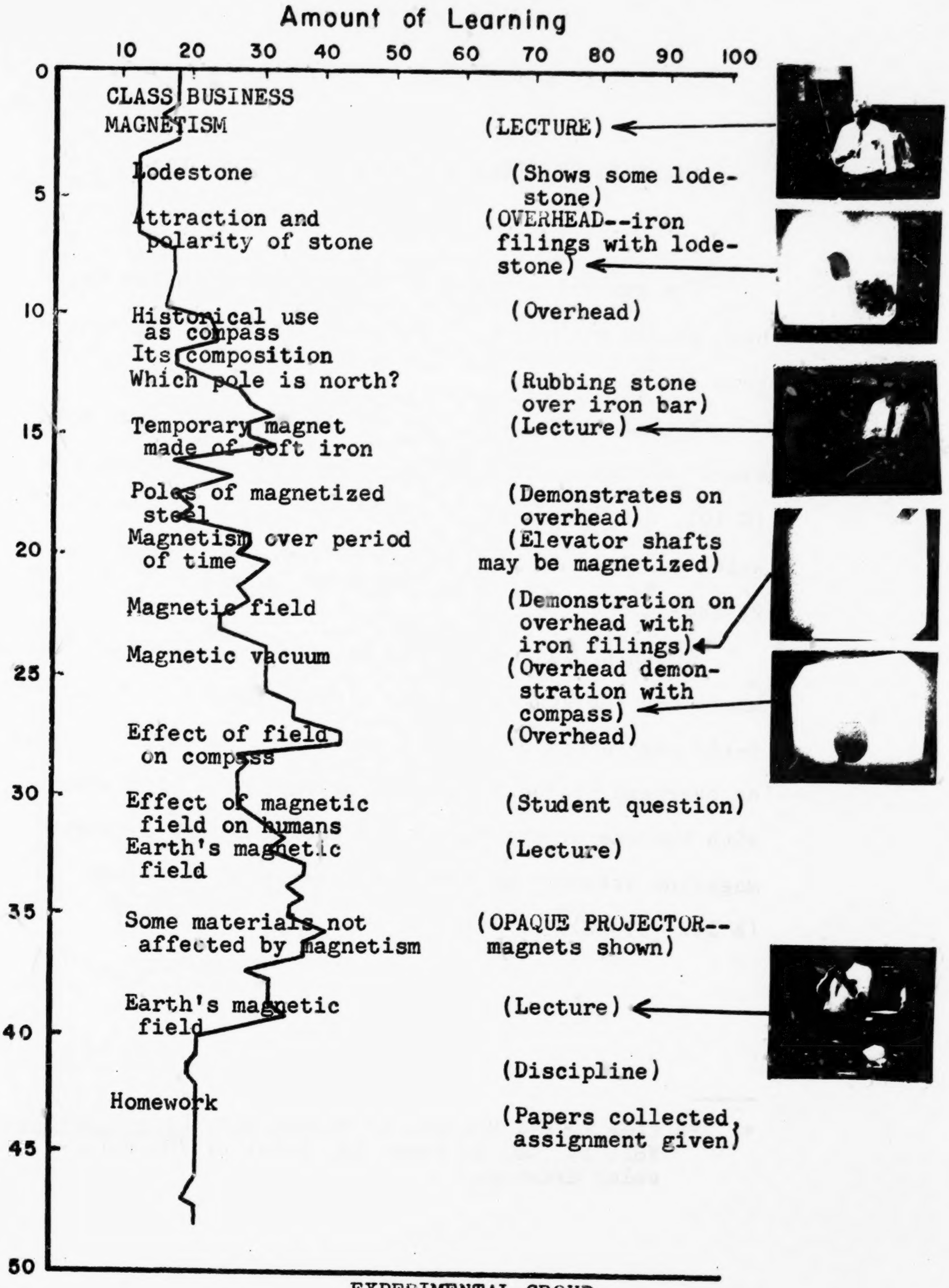
* "What Is Magnetism?", McGraw Hill Book Co., 1953. color, 61 frames.



LEARNING PROFILE NUMBER 191



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 192

ANALYSIS OF LEARNING PROFILES 191 AND 192

The general pattern of learning was similar in both groups with some of the same demonstrations in both groups.

Within each group some variations developed, however. In the Control Group, a lecture with objects (C 191, 8-13) was not as effective as demonstrations which resulted in high points of learning (C 191, 15, 27 and 34).

Learning was low in the Experimental Group at points where the subject matter was already familiar (E 192, 5-18) regardless of their presentation by either lecture or overhead projector. Learning reached a high point with the use of the opaque projector to show a recent magazine article* on some new aspects of magnetism (E 192, 37-40).

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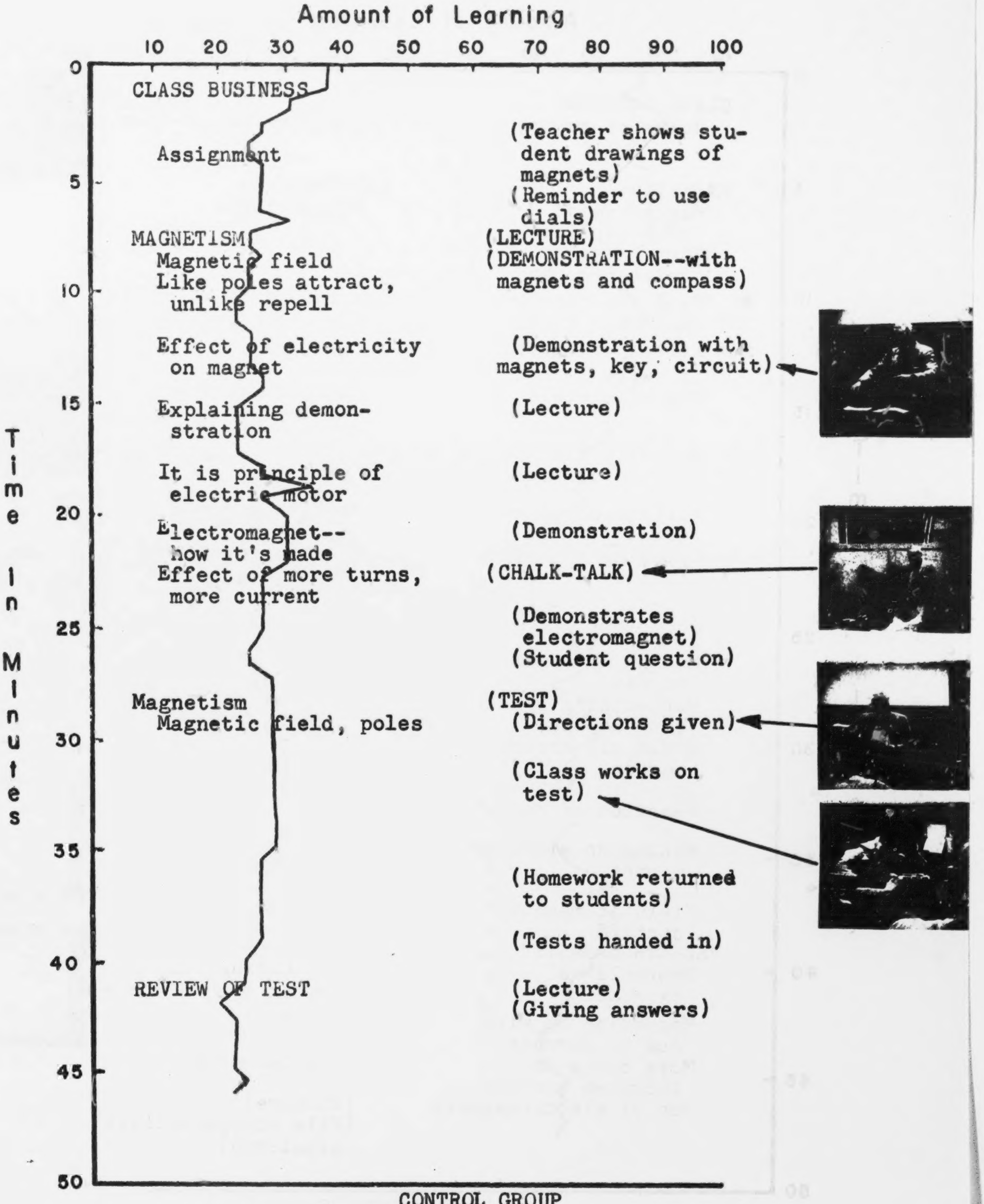
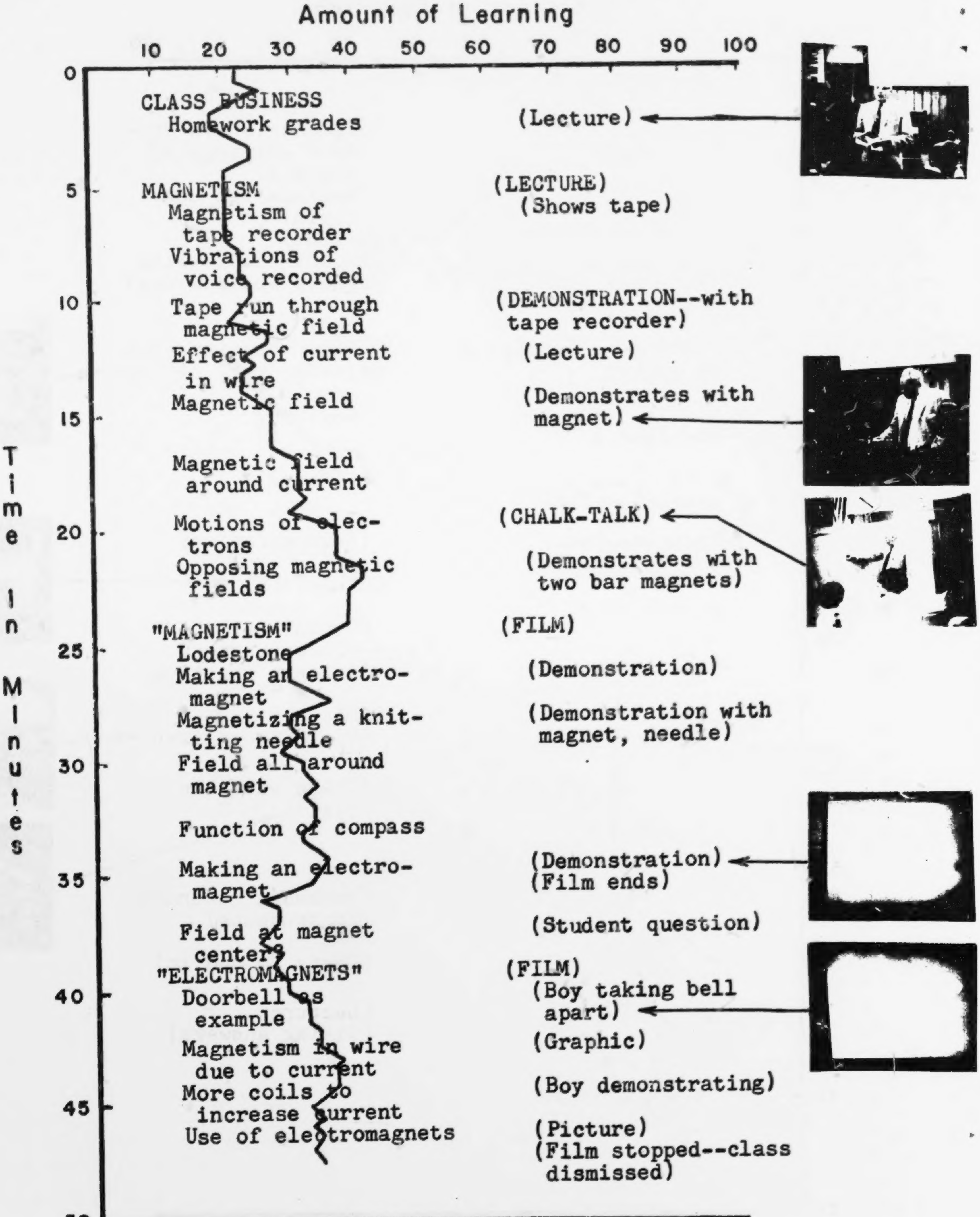
* "A Clue to the Mystery of Magnetism", Life Magazine. Vol. 49, No. 22 (Nov. 28, 1960) p. 70, multi-color drawing.



CONTROL GROUP

LEARNING PROFILE NUMBER 193



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 194

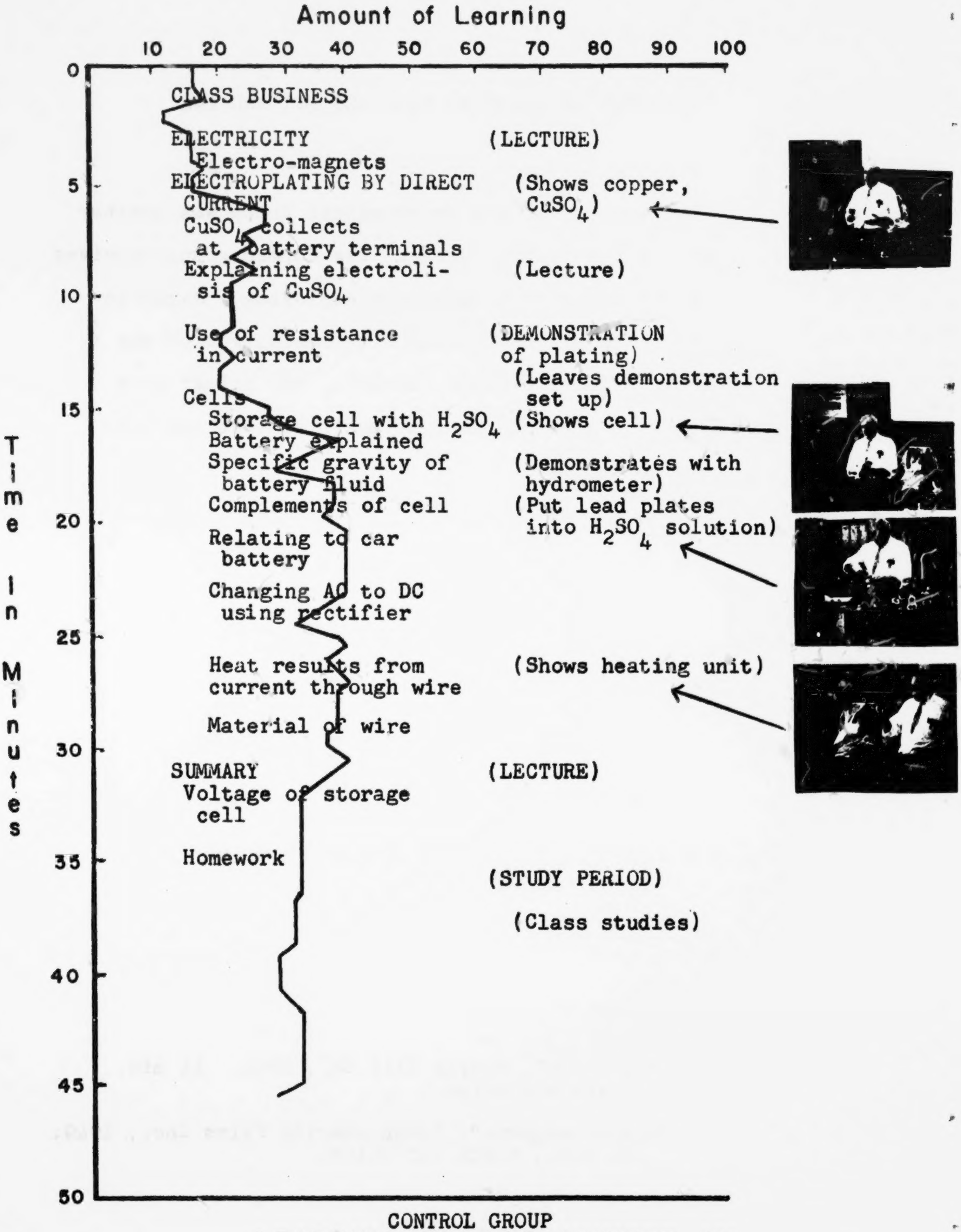
ANALYSIS OF LEARNING PROFILES 193 AND 194

Learning in the Experimental Group was greater than in the Control Group. The former group received a demonstration of magnetism employing a magnetic tape recorder (E194, 7-12). A demonstration was highly effective (E194, 19-25). Two films* were effective although part of their content had been covered earlier.

---

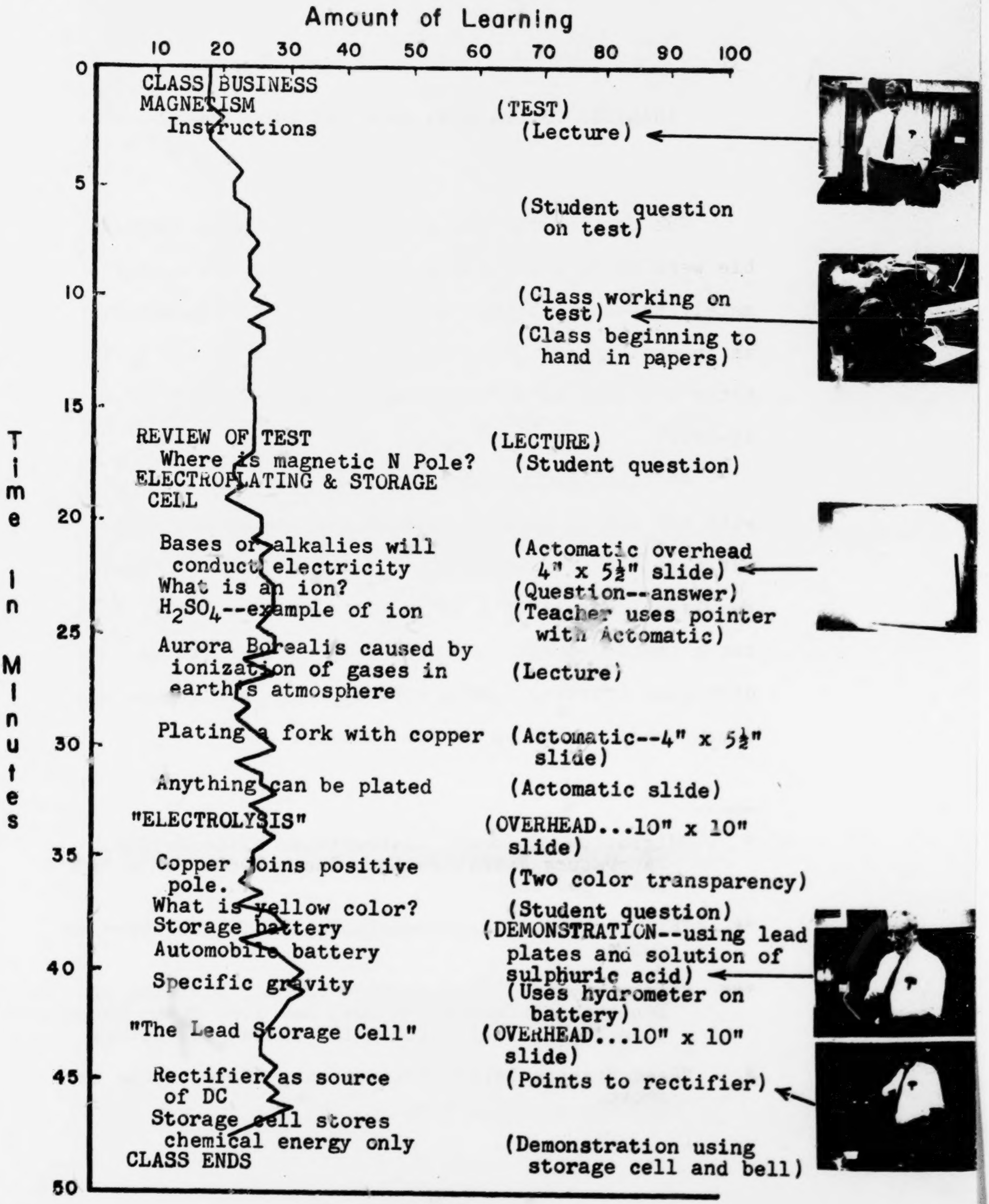
* "Magnetism", McGraw Hill Co., 1955. 11 min., black and white.

"Electromagnets", Young America Films Inc., 1949. 11 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 195



EXPERIMENTAL
LEARNING PROFILE NUMBER 196

ANALYSIS OF LEARNING PROFILES 195 AND 196

The portions of the profiles which were comparable were on electroplating, and learning was approximately the same whether the demonstration was direct as in the Control Group (C 195, 5-14) or by the Actomatic overhead as in the Experimental Group (E 196, 19-33).

Within the Experimental Group learning increased with the use of slides prepared for use on the Actomatic (E 196, 29* and 32**). Another slight increase resulted from use of a 10" x 10" slide*** (E 196, 34), but a familiar topic on a 10" x 10" slide# led to decreased learning. More effective in both groups was demonstration with an active battery.

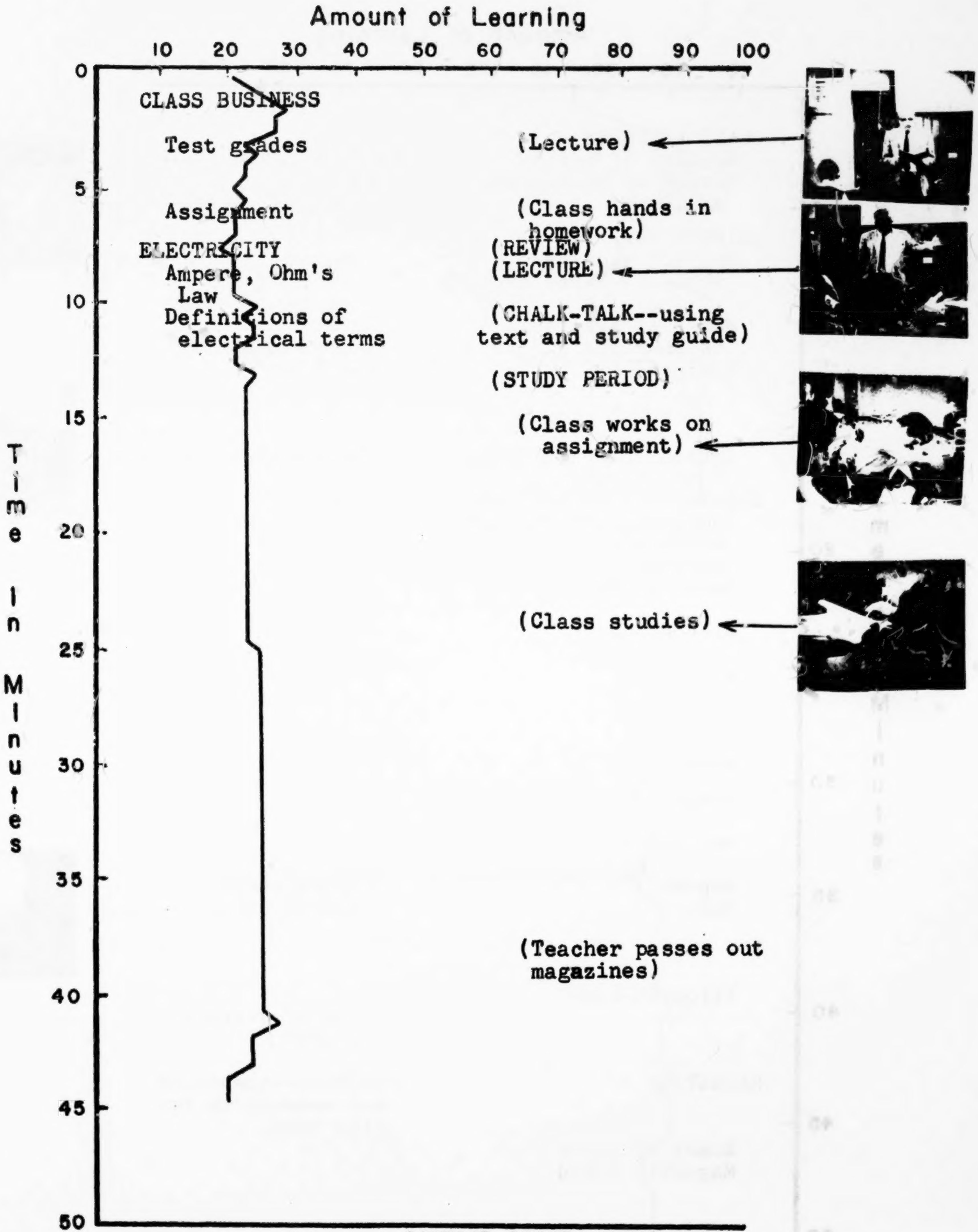
---

* "Migration of Ions", Instructolab slide C-3200, Laboratory Furniture Co., Inc., 1960. 4" x 5½", black and white.

** "Electrolytes", Instructolab slide C-9200, same as above.

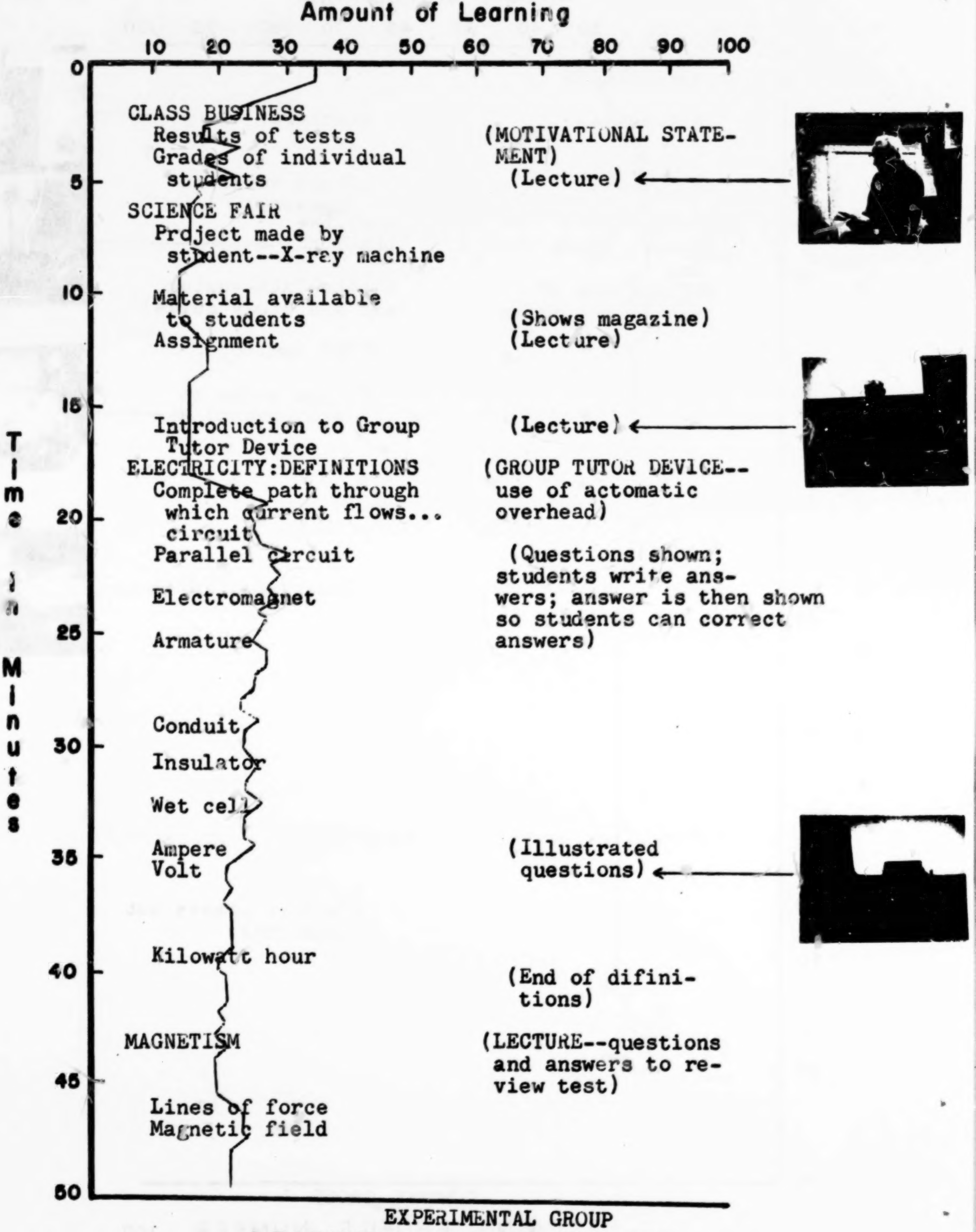
*** "Electrolysis", Transparency IX. N., Division of Educational Communications, New York State Education Dept., 1961. 10" x 10" slide, two colors.

# "Lead Storage Cell", Transparency IX. O., same as above.



CONTROL GROUP

LEARNING PROFILE NUMBER 197

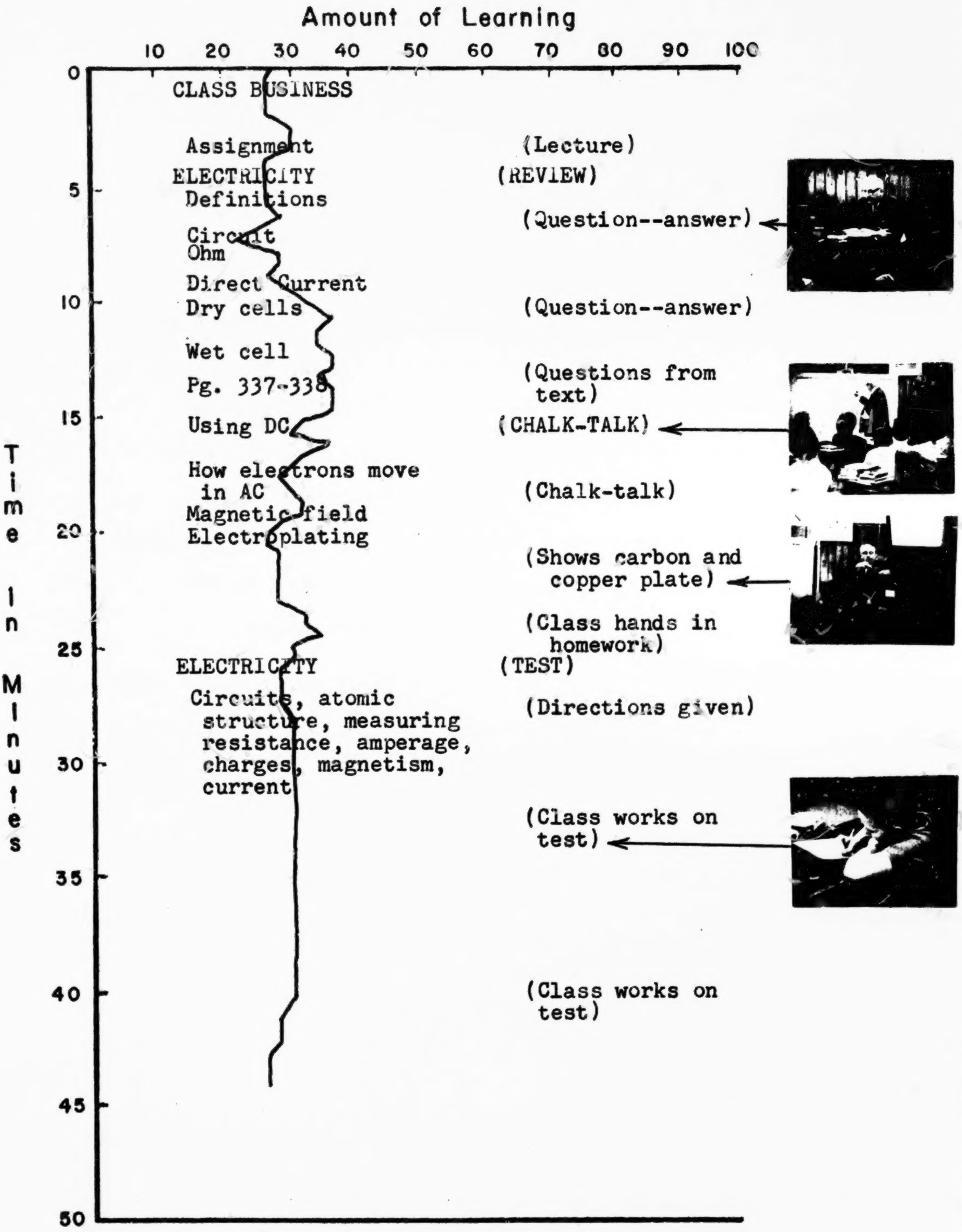


EXPERIMENTAL GROUP

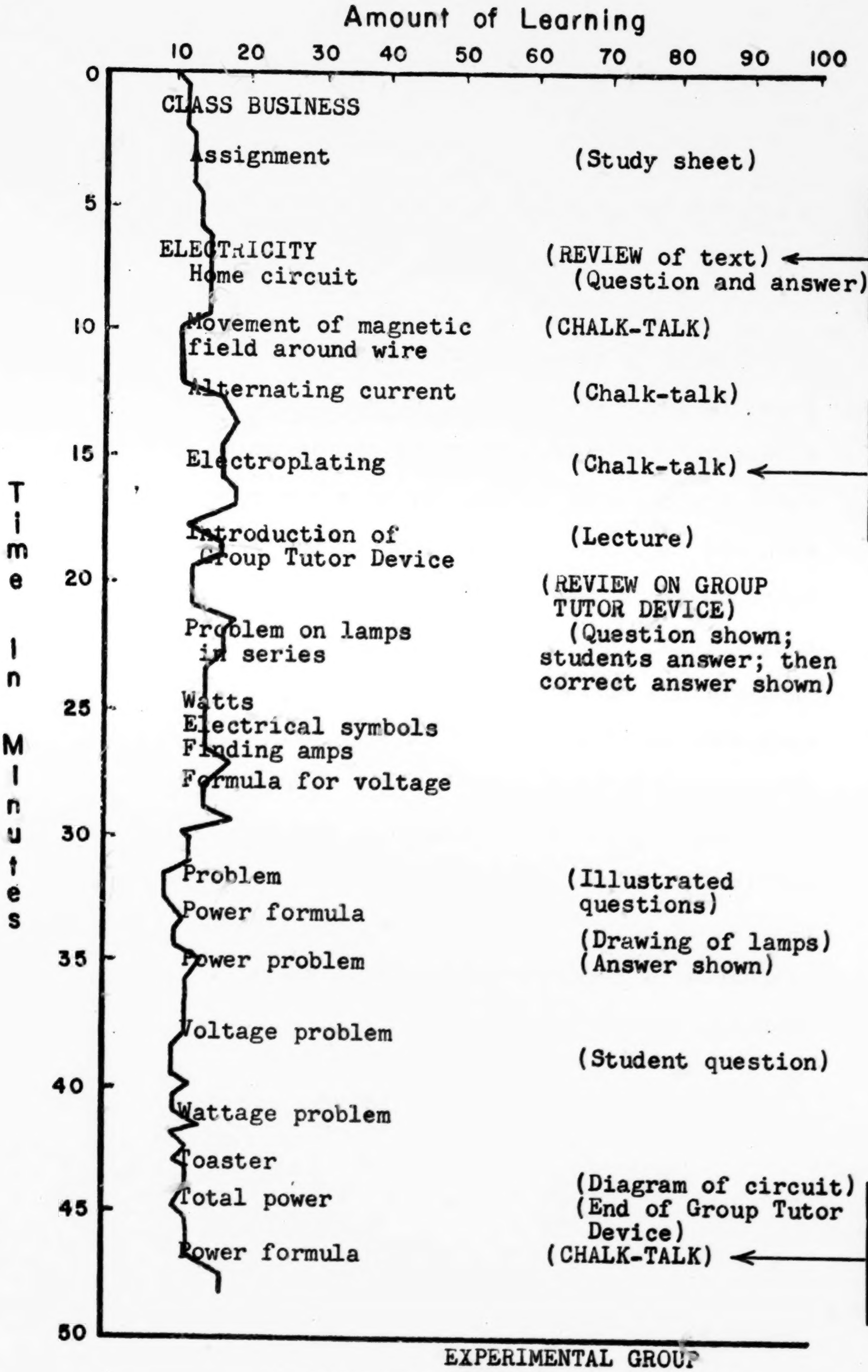
LEARNING PROFILE NUMBER 198

ANALYSIS OF LEARNING PROFILES 197 and 198

Learning profiles 197 and 198 afforded an opportunity to compare three different methods of review. Although review of any type was regularly not highly effective, review by the Group Tutor Device (E198, 18-40) was more effective than lecture giving answers to a review test (studied at this time, not taken by the class, E198, 44-49) or individual study (E197, 14-40).



CONTROL
LEARNING PROFILE NUMBER 199

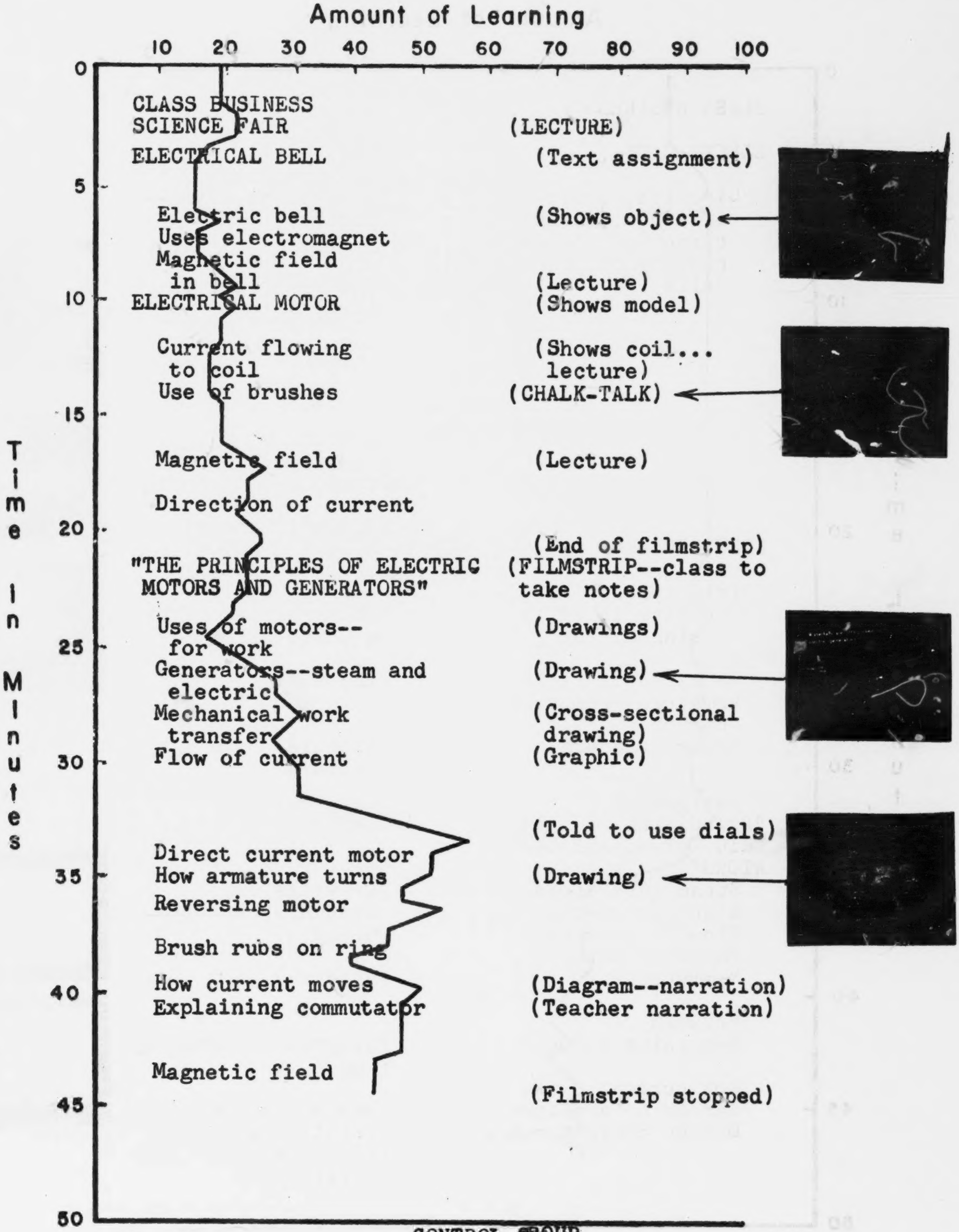


EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 200

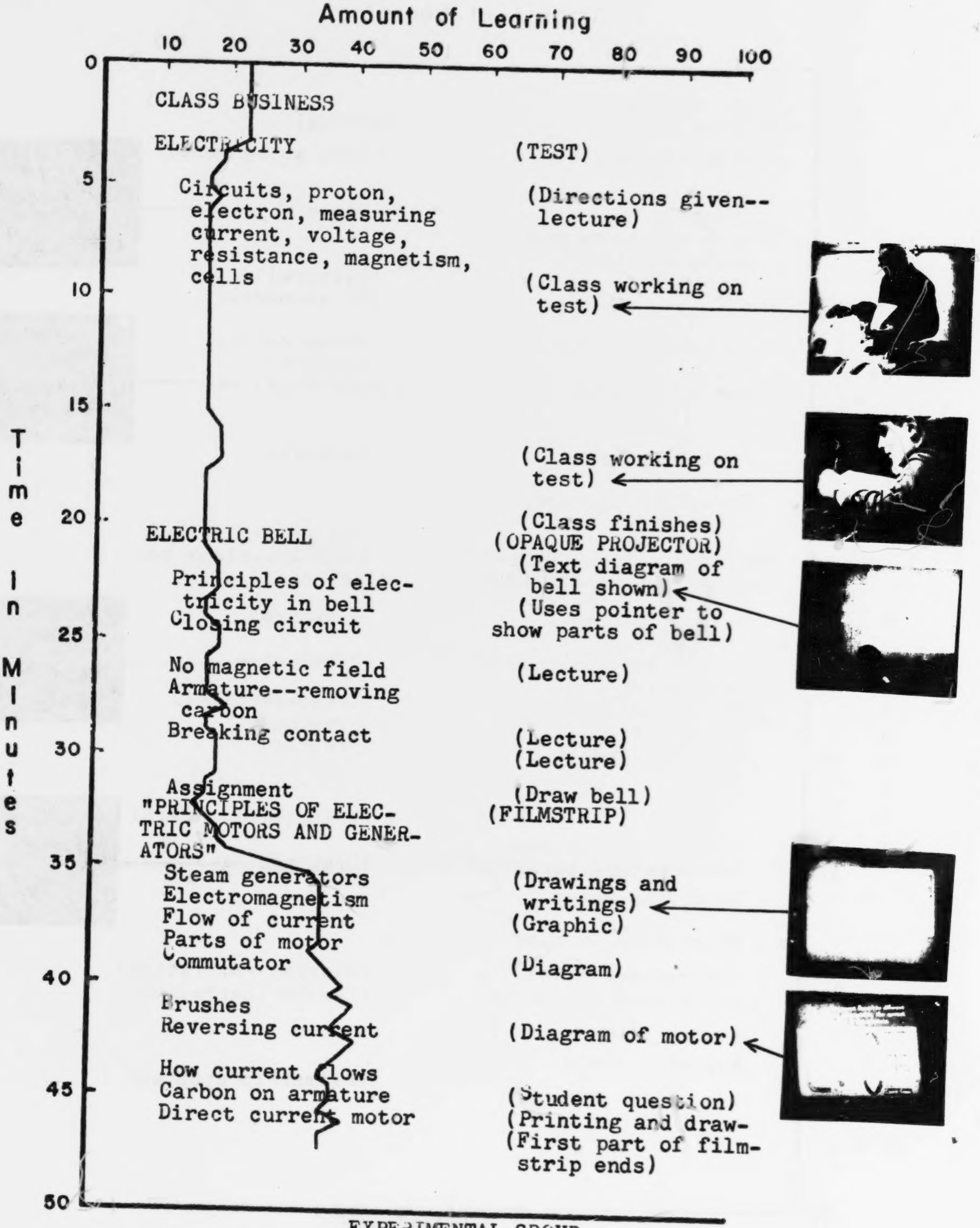
ANALYSIS OF LEARNING PROFILES 199 and 200

Review by questions and answers to the class (C 199, 5-14) proved to be slightly more effective than review by means of the Group Tutor Device. The reason for this may have been the fact that the program for the Group Tutor Device required the students to be very busy writing answers and checking them so that many did not operate their dials for the program analyzer; and the program included a review of many simple but basic parts of the unit whereas the Control Group concentrated on relatively difficult problems. However, the Group Tutor Device did result in some fairly significant increases in learning particularly where problems were presented.



CONTROL GROUP

LEARNING PROFILE NUMBER 201



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 202

ANALYSIS OF LEARNING PROFILES 201 and 202

Presenting an electric bell by means of regular demonstration (C 201, 5-9) did not differ in its effect upon learning from the use of an opaque projector to show a bell and a diagram of a bell (C 202, 21-31).

A filmstrip * indicated greater learning in the Control Group because more time was given to adequate filmstrip coverage (C 201, 22-45) and a reminder was given to the students to turn up their dials when learning (C 201, 33) which made the Control Group oblige by turning their dials up. In the Experimental Group, less time was devoted to the filmstrip (E 202, 34-46).

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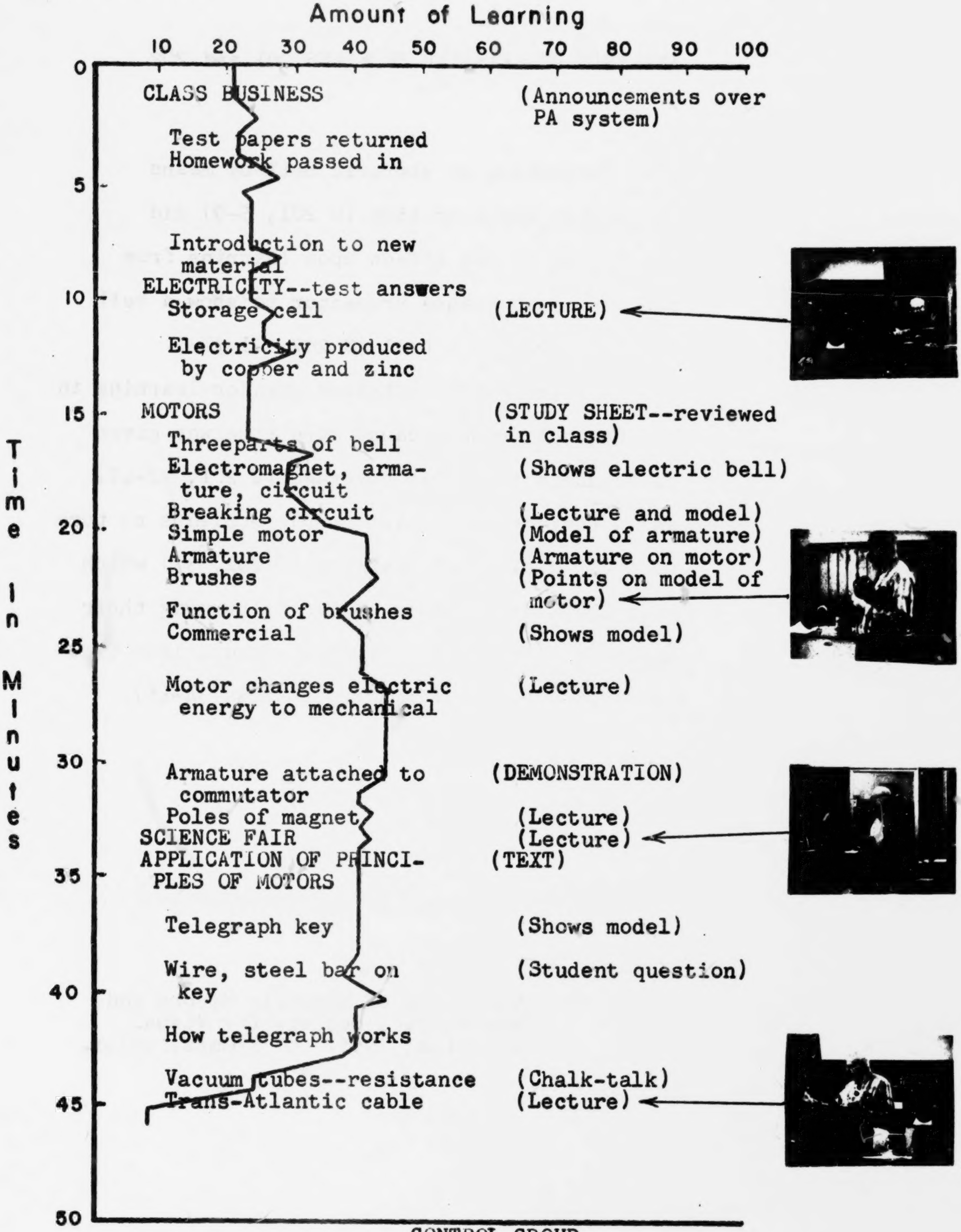
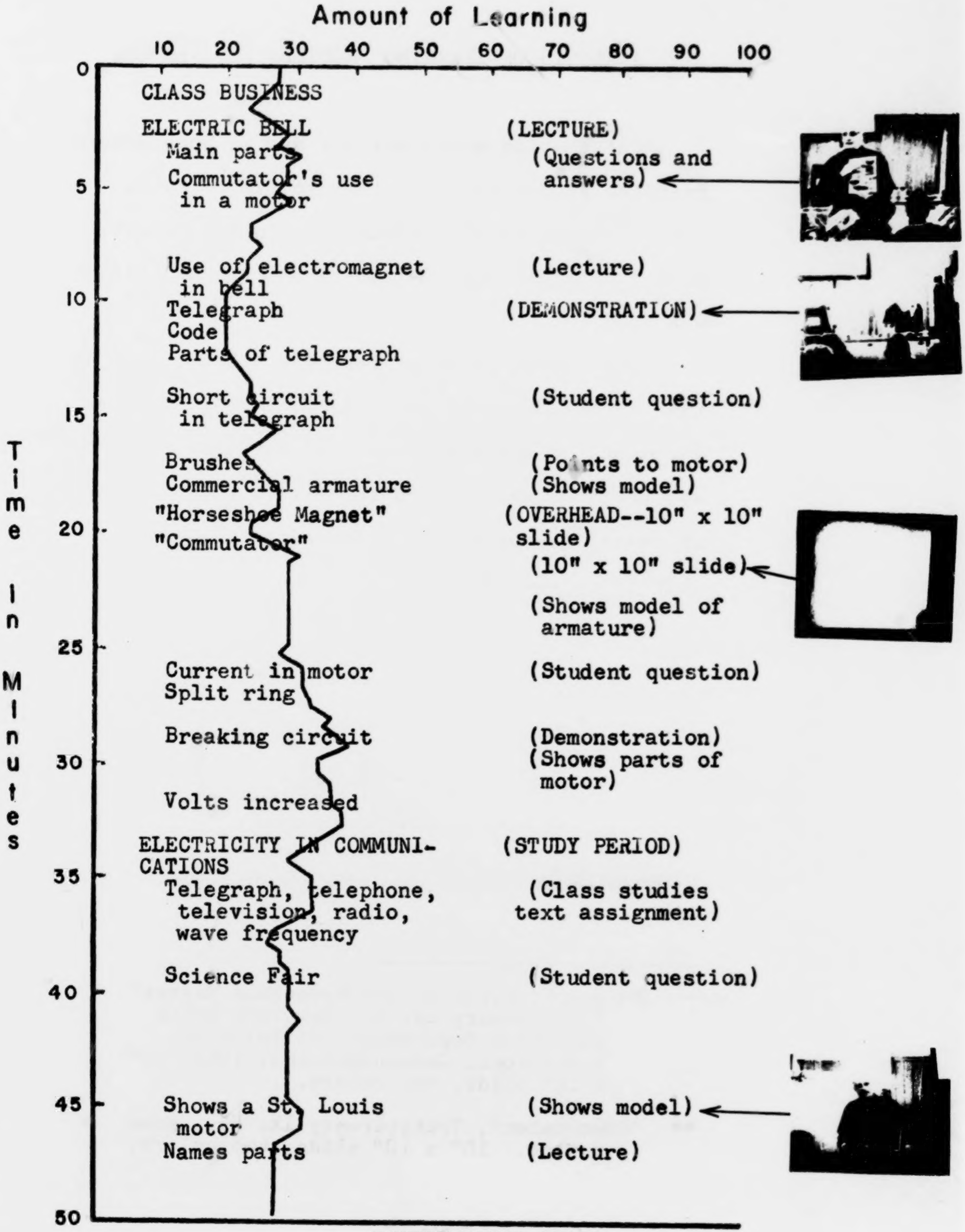
* "The Principles of Electric Motors and Generators", Society for Visual Education, 1955. 67 frames, color.



CONTROL GROUP

LEARNING PROFILE NUMBER 203



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 204

ANALYSIS OF LEARNING PROFILES 203 and 204

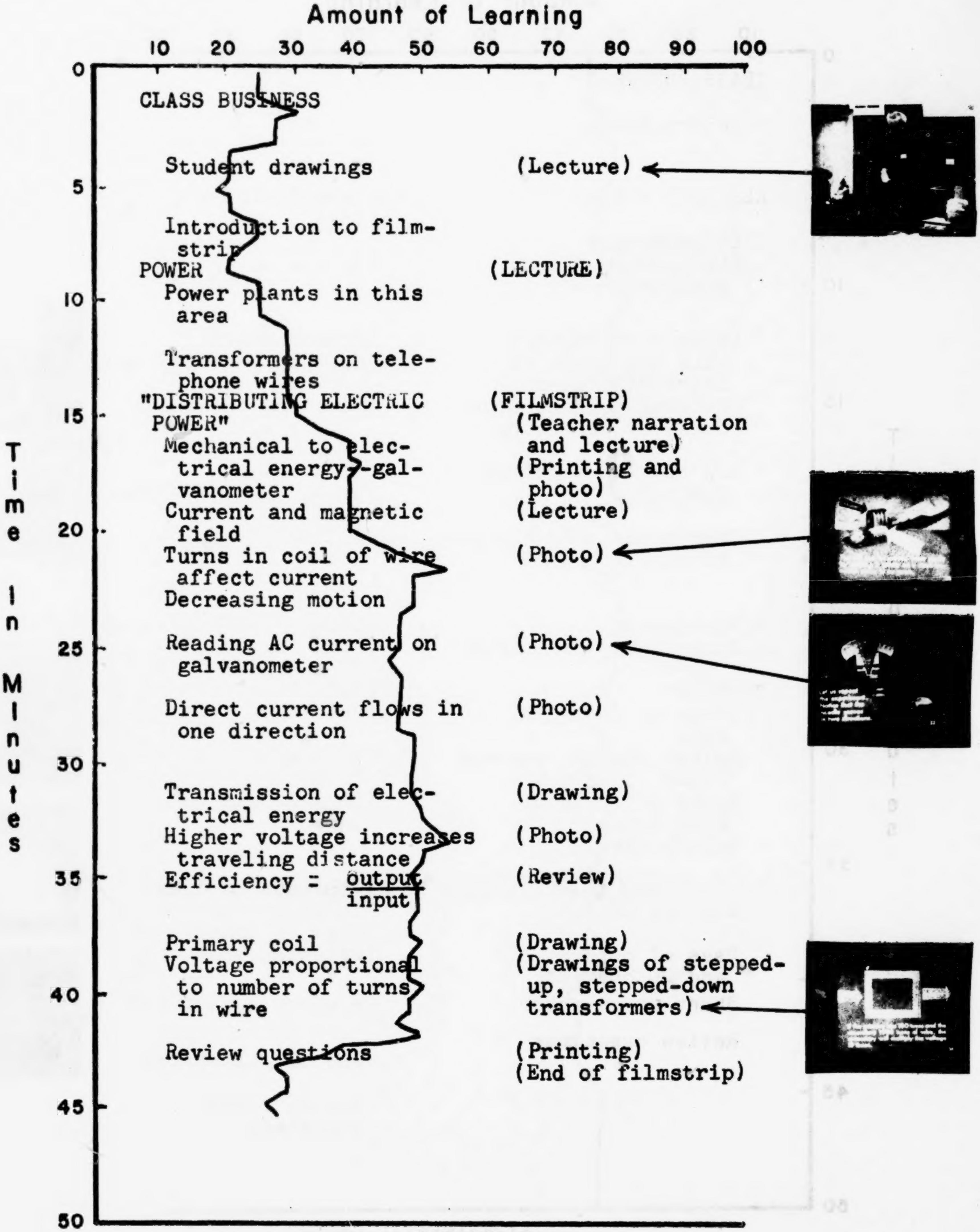
Information which was not new in both groups resulted in decreases in learning in both the Control Group (C 203, 18-19) and in the Experimental Group (E 204, 19) where an overhead slide* was used.

The lowest point of learning had occurred in the Control Group (C 201, 42 and C 203, 32) when a commutator was explained. An overhead slide** was prepared which paved the way (E 204, 22) for increased learning from a demonstration with objects (E 204, 24-30).

---

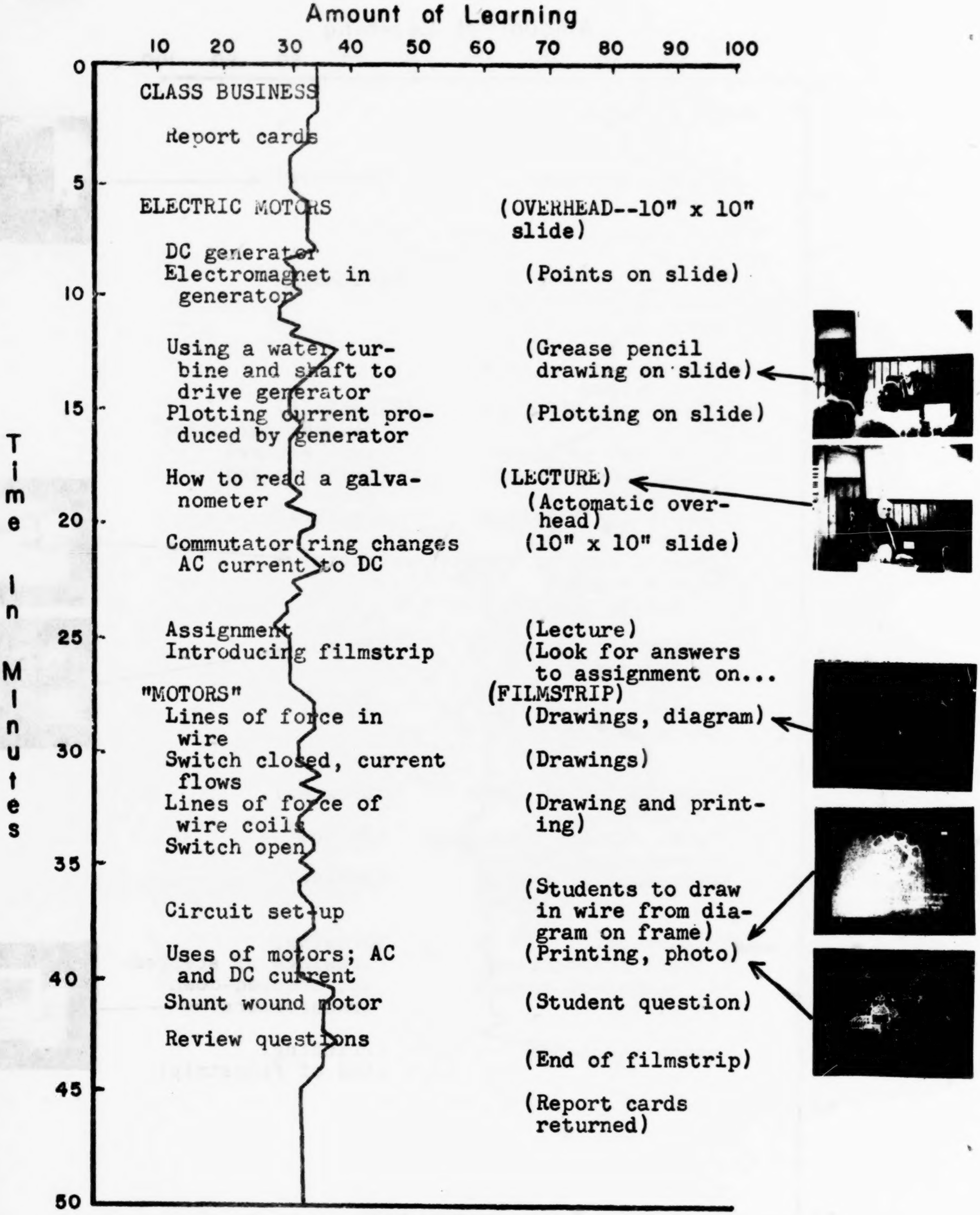
* "Magnetic Field of the Horseshoe Magnet" Transparency IX. R., New York State Education Department, Division of Educational Communications, 1961. 10" x 10" slide, two colors.

** "Commutator", Transparency IX. NN., same source. 10" x 10" slide, two colors.



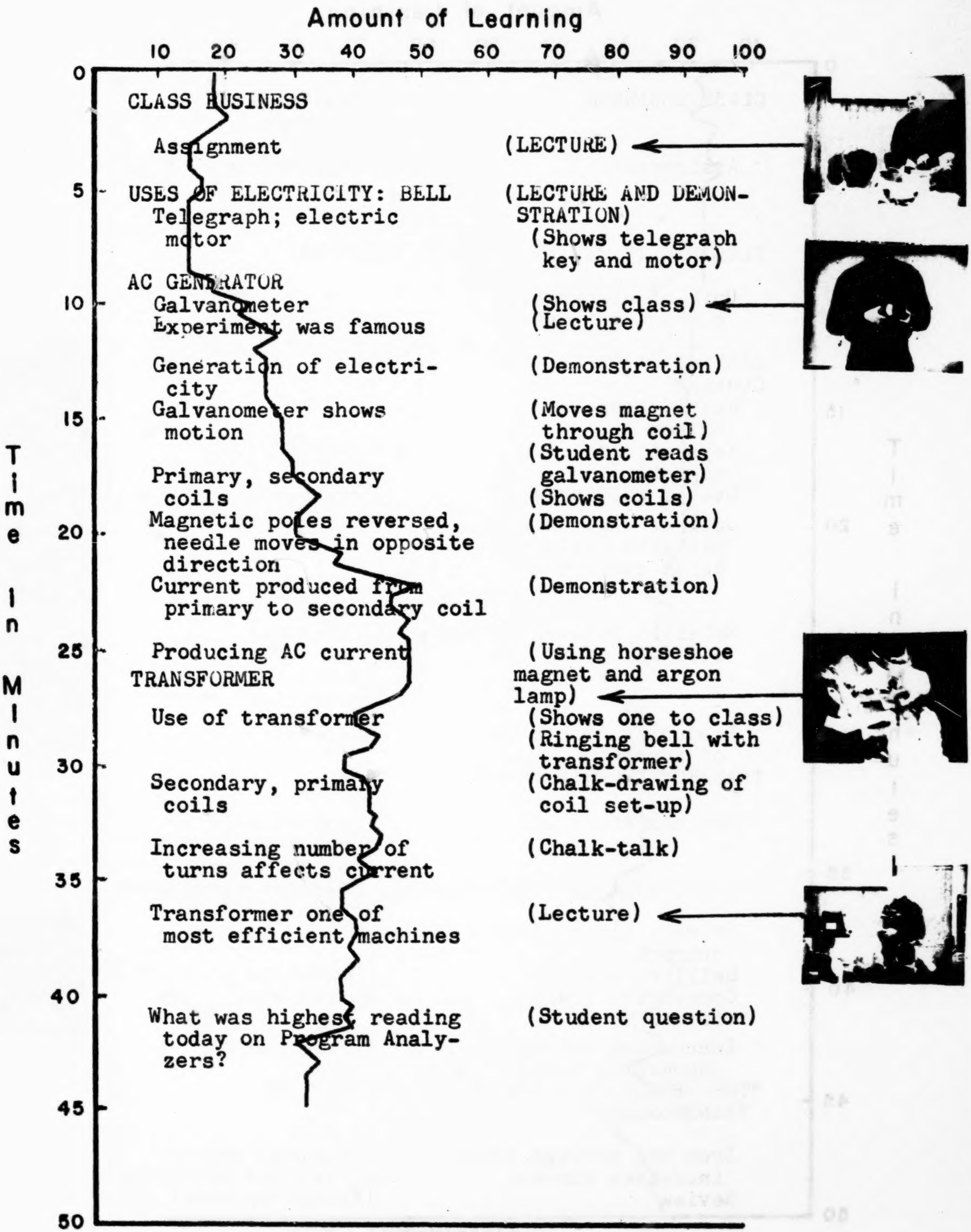
CONTROL GROUP

LEARNING PROFILE NUMBER 205



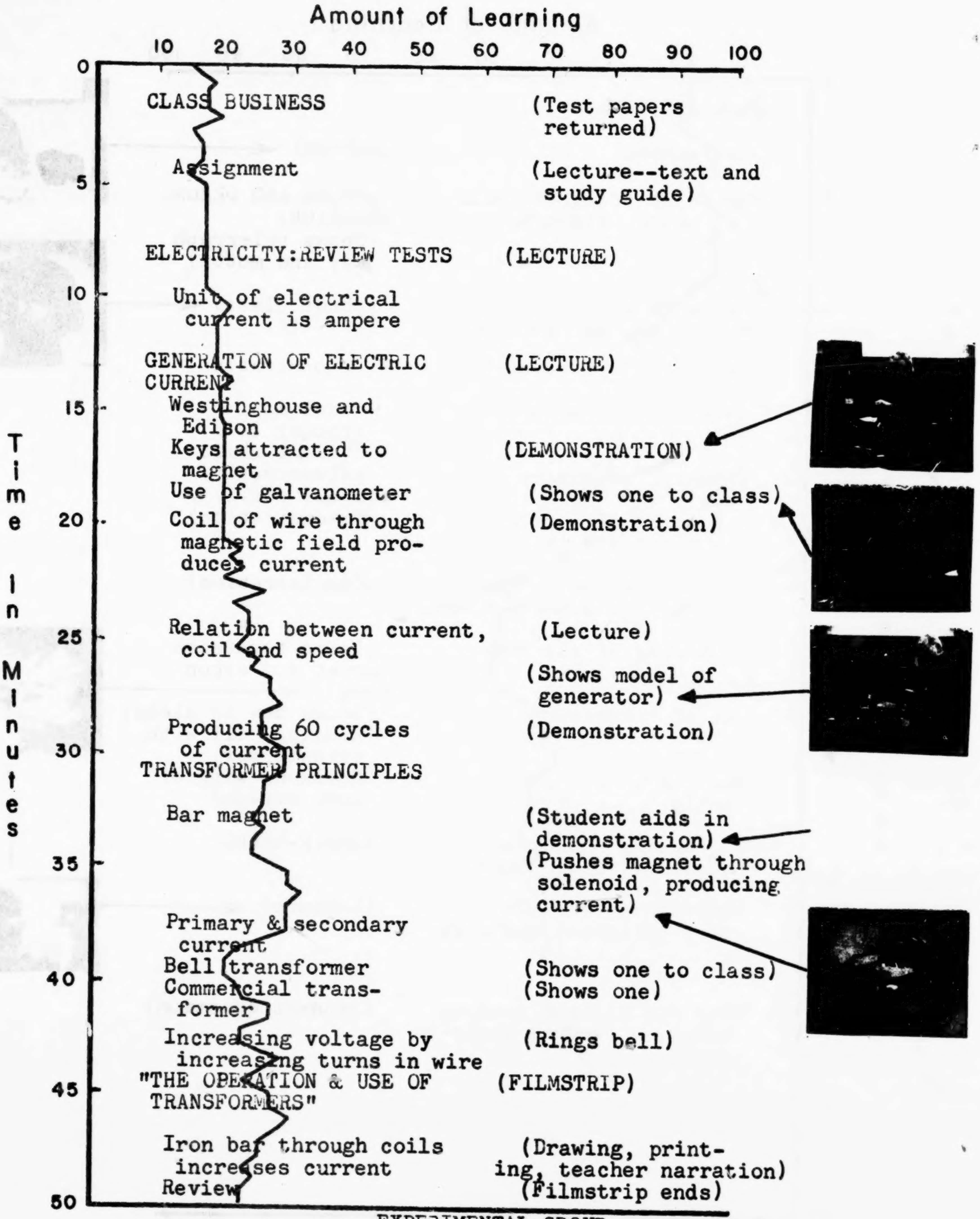
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 206



CONTROL GROUP

LEARNING PROFILE NUMBER 207



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 208

ANALYSIS OF LEARNING PROFILES 207 and 208

The same demonstrations were presented in both groups. The profiles were similar at the particular points where the same presentation was made. For instance, a high point on primary and secondary current (C 207, 23 and E 208, 37) is indicated.

A filmstrip* was presented so briefly that it yielded no changes in learning (E 208, 45-50).

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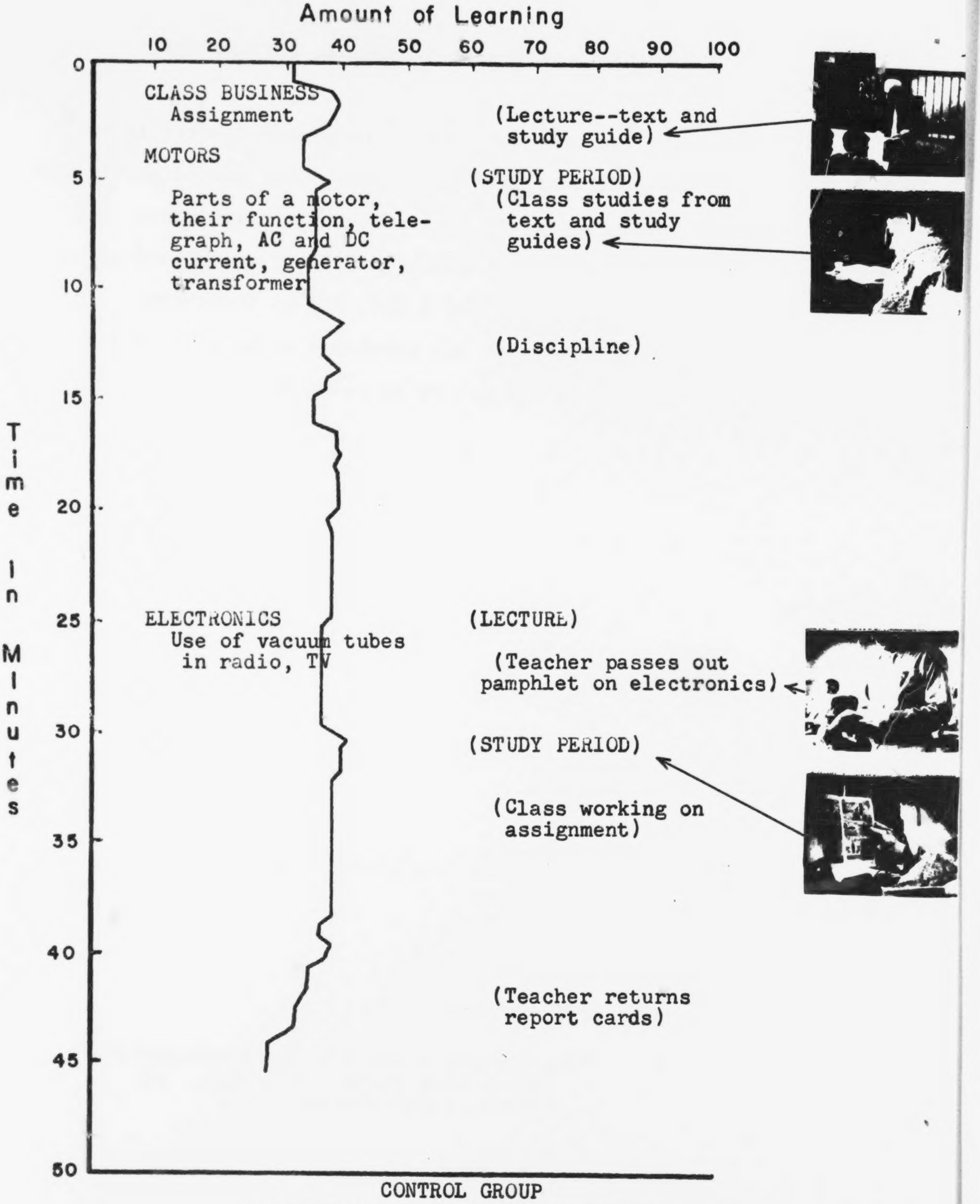
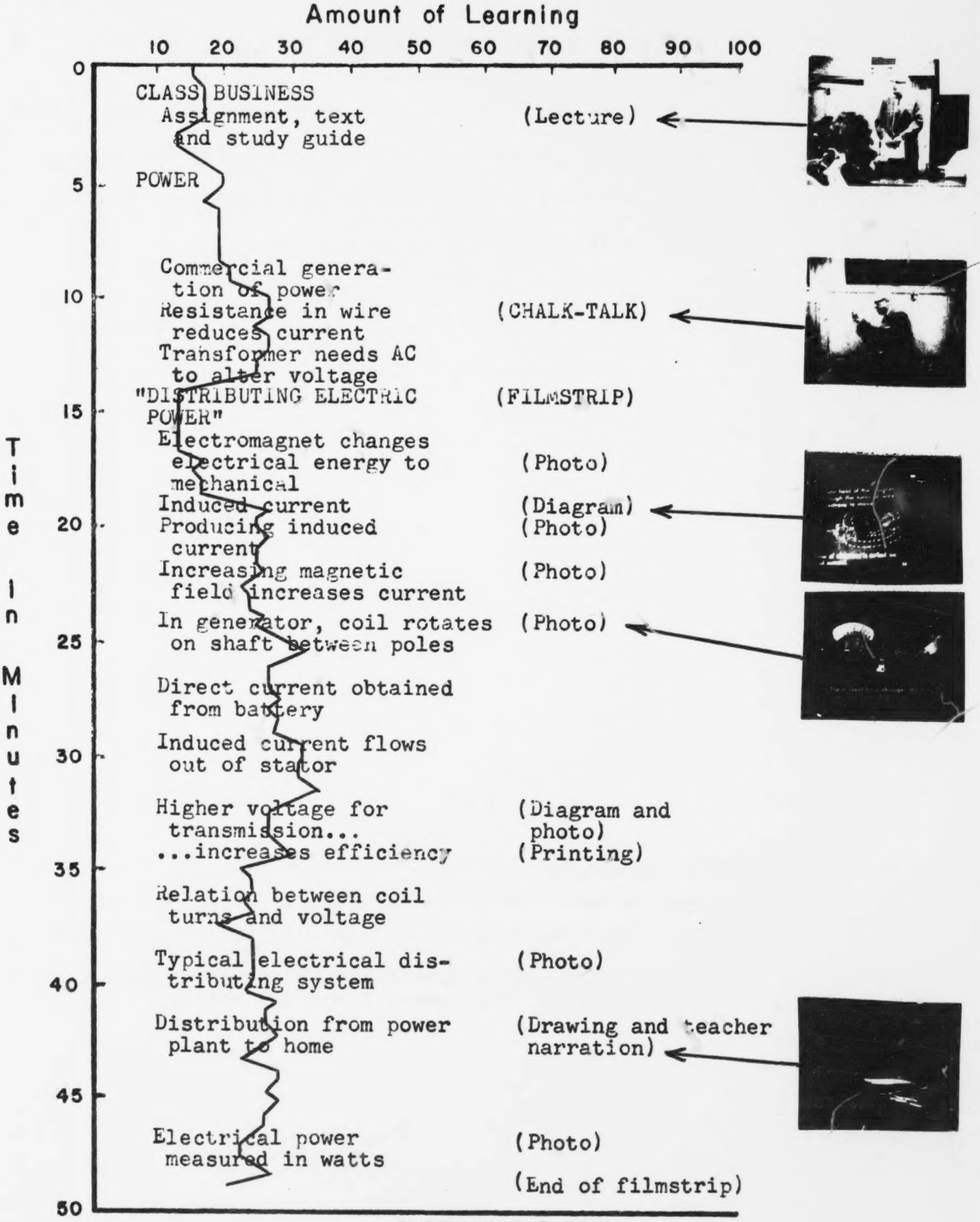
* "The Operation and Use of Transformers", Vernon Long Filmslides, N.D. 32 frames, black and white.



CONTROL GROUP
LEARNING PROFILE NUMBER 209



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 210

ANALYSIS OF LEARNING PROFILES 209 and 210*

Study and lecture did not result in as significant variations in learning as a filmstrip** Diagrams in the filmstrip led to significant increases (E 212, 19 and 32).

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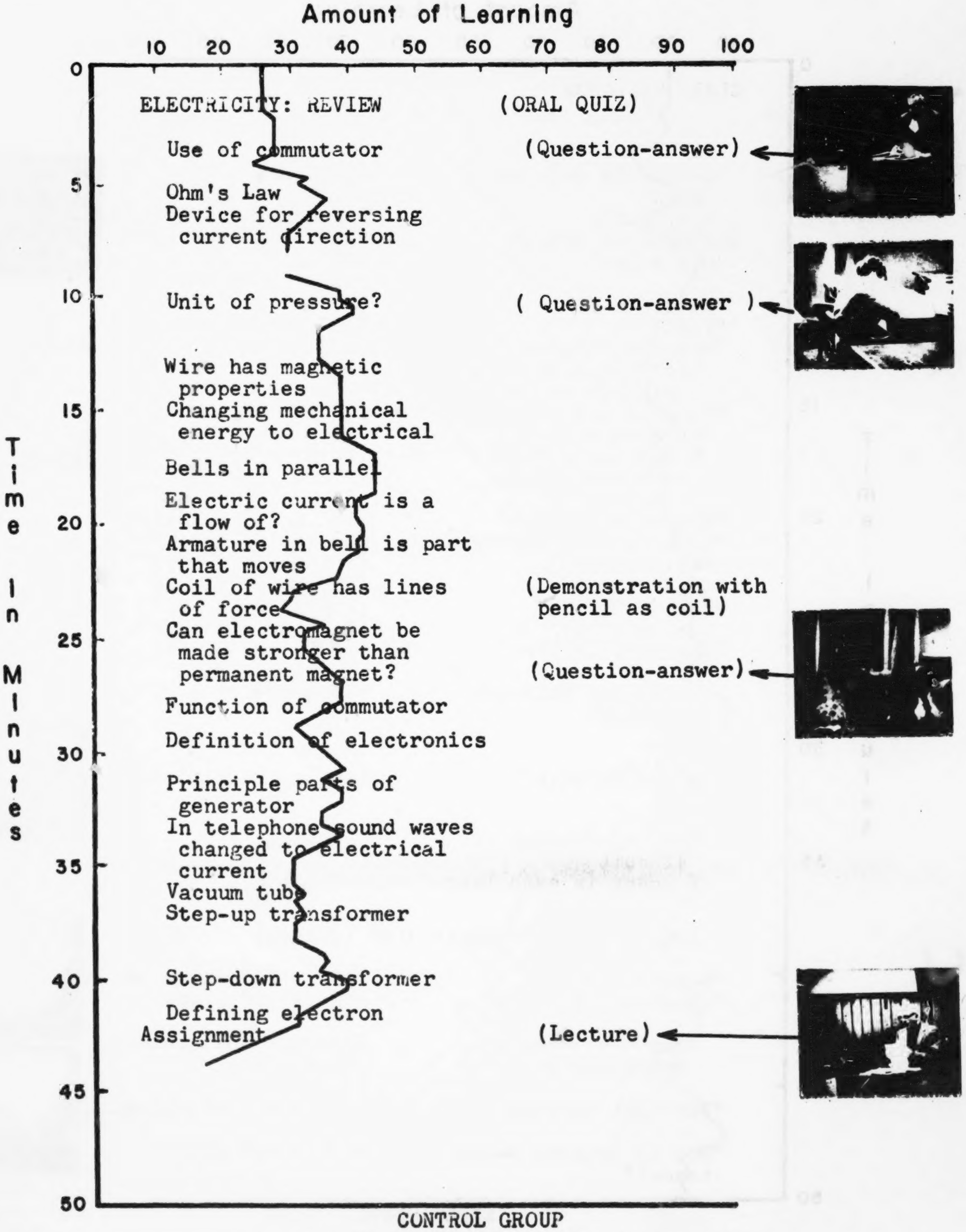
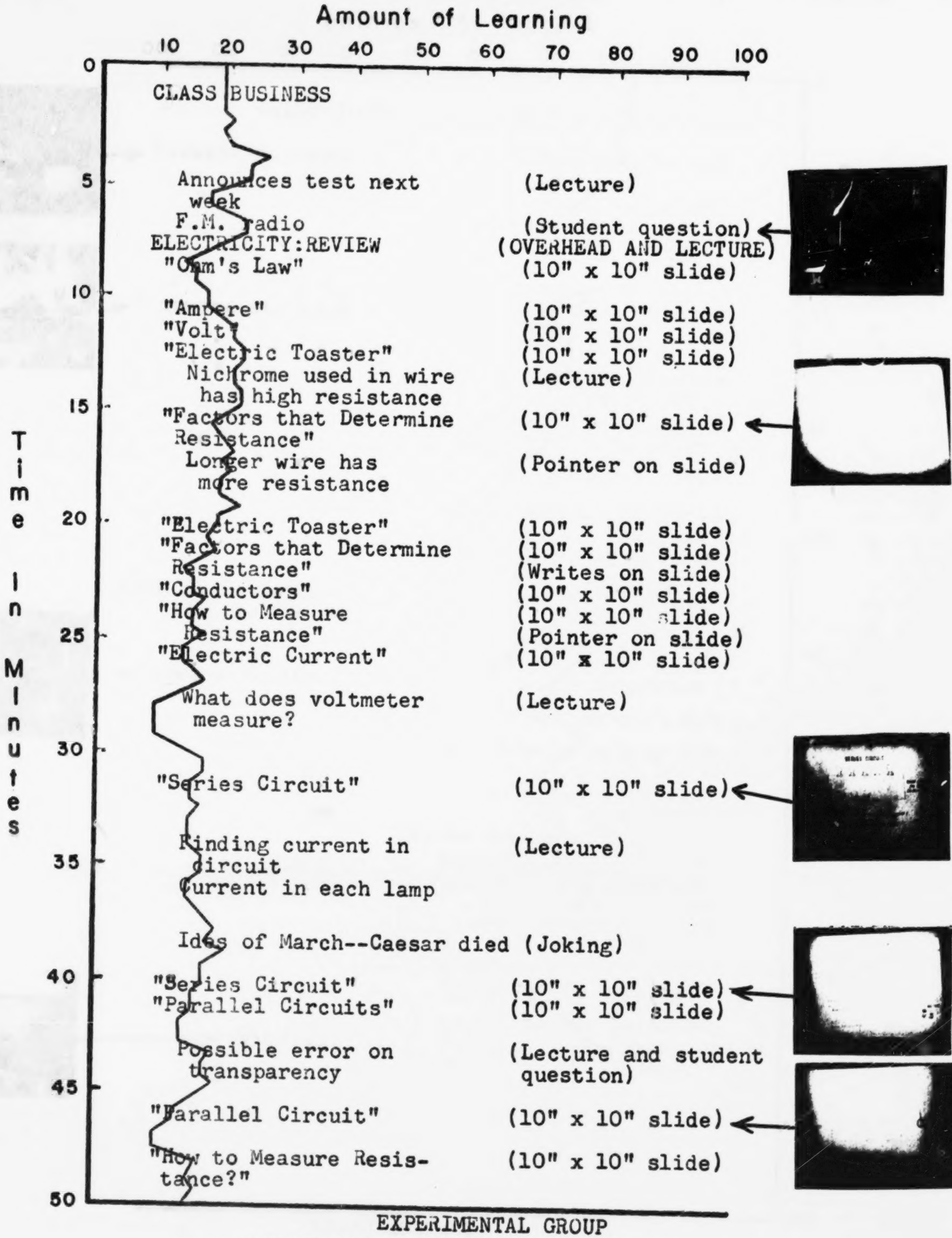
* See also Analysis of Learning Profiles 205 and 206.

** "Distributing Electric Power", McGraw-Hill Book Co., 1951. 53 frames, black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 211



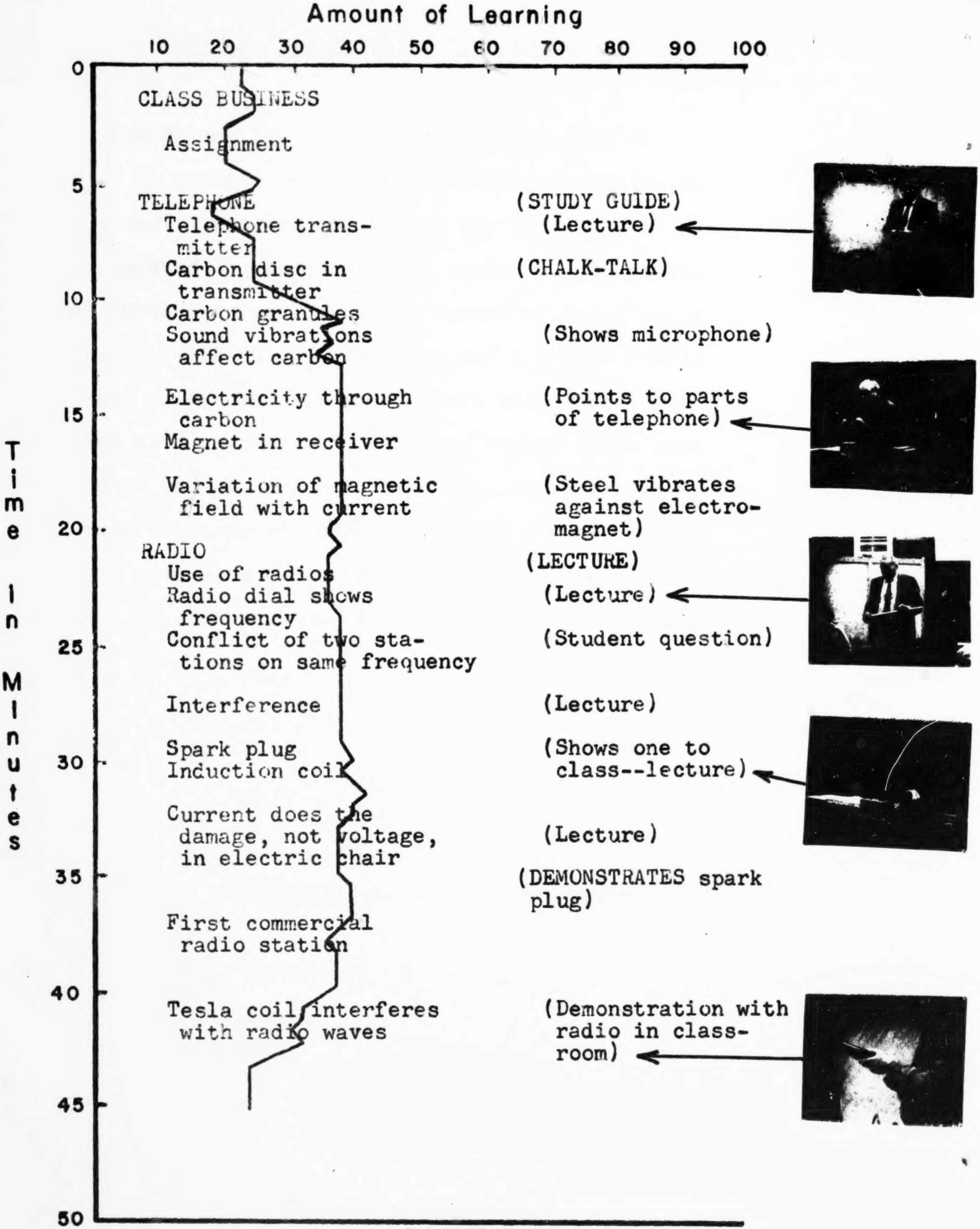
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 212

ANALYSIS OF LEARNING PROFILES 211 and 212

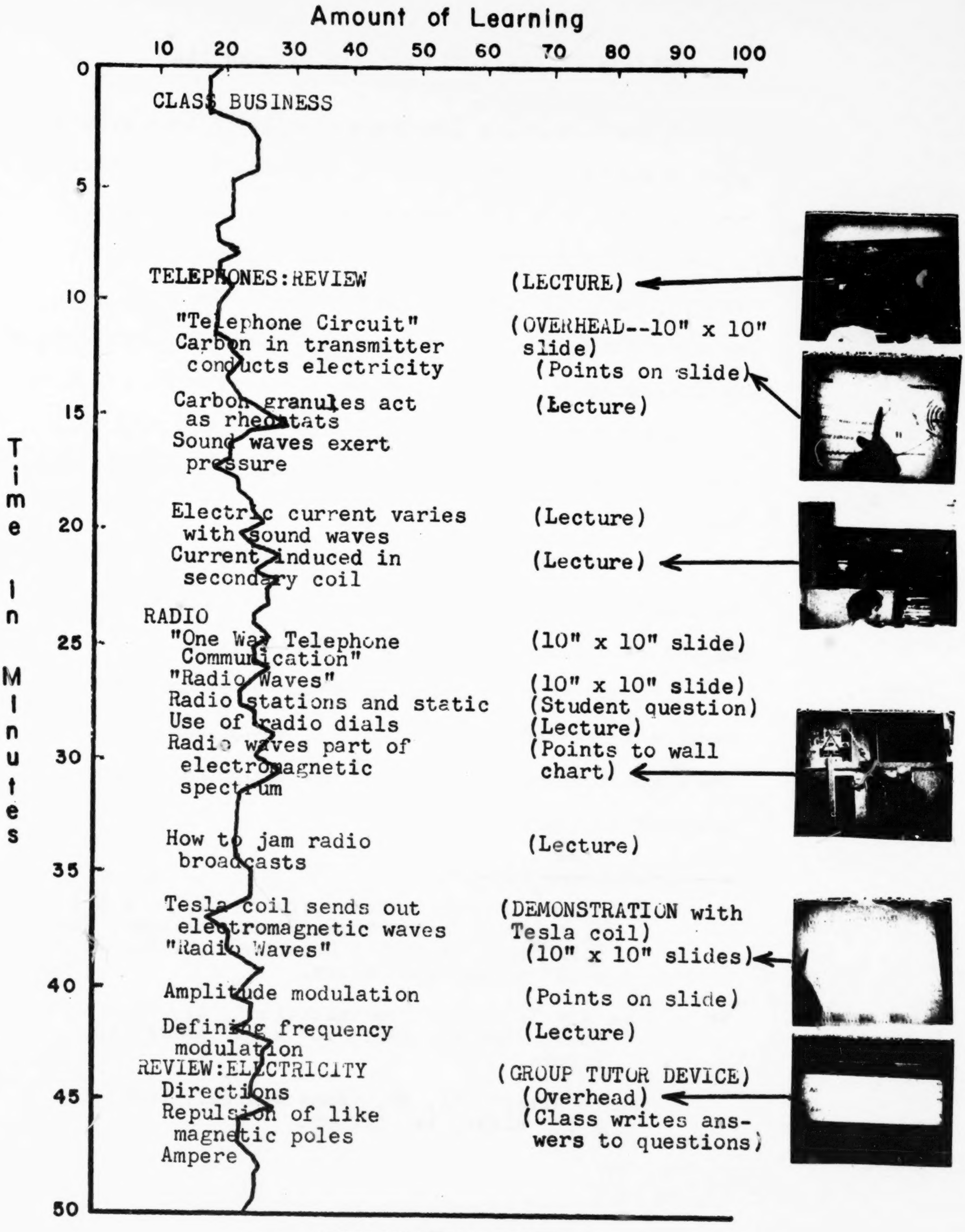
In both groups the profiles did not show a great amount of difference in the degrees of learning. This was typical of reviews. The particular technique did not appear to have a significant influence although lecture between two slides caused a low point (E 212, 28-29).

The overhead slides were all ones which had been shown before in class, but even so they were presented so rapidly that learning did not reach a high level. Interviews with the students were conducted later and they indicated that they needed more time to look at such visuals.



CONTROL GROUP

LEARNING PROFILE NUMBER 213



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 214

ANALYSIS OF LEARNING PROFILES 213 and 214

Student learning increased sharply in both groups when students learned of carbon granules in telephone transmitters. In the Control Group this was shown by a demonstration with an object, the telephone itself. (C 213, 11). In the Experimental Group the means was an overhead transparency* which presented the information by a cross-sectional diagram.

Greater variations in learning resulted from the use of overhead transparencies ** than from lecture and demonstration with objects.

The methods used in the Experimental Group resulted in presentation of more information than was presented by the procedures used in the Control Group.

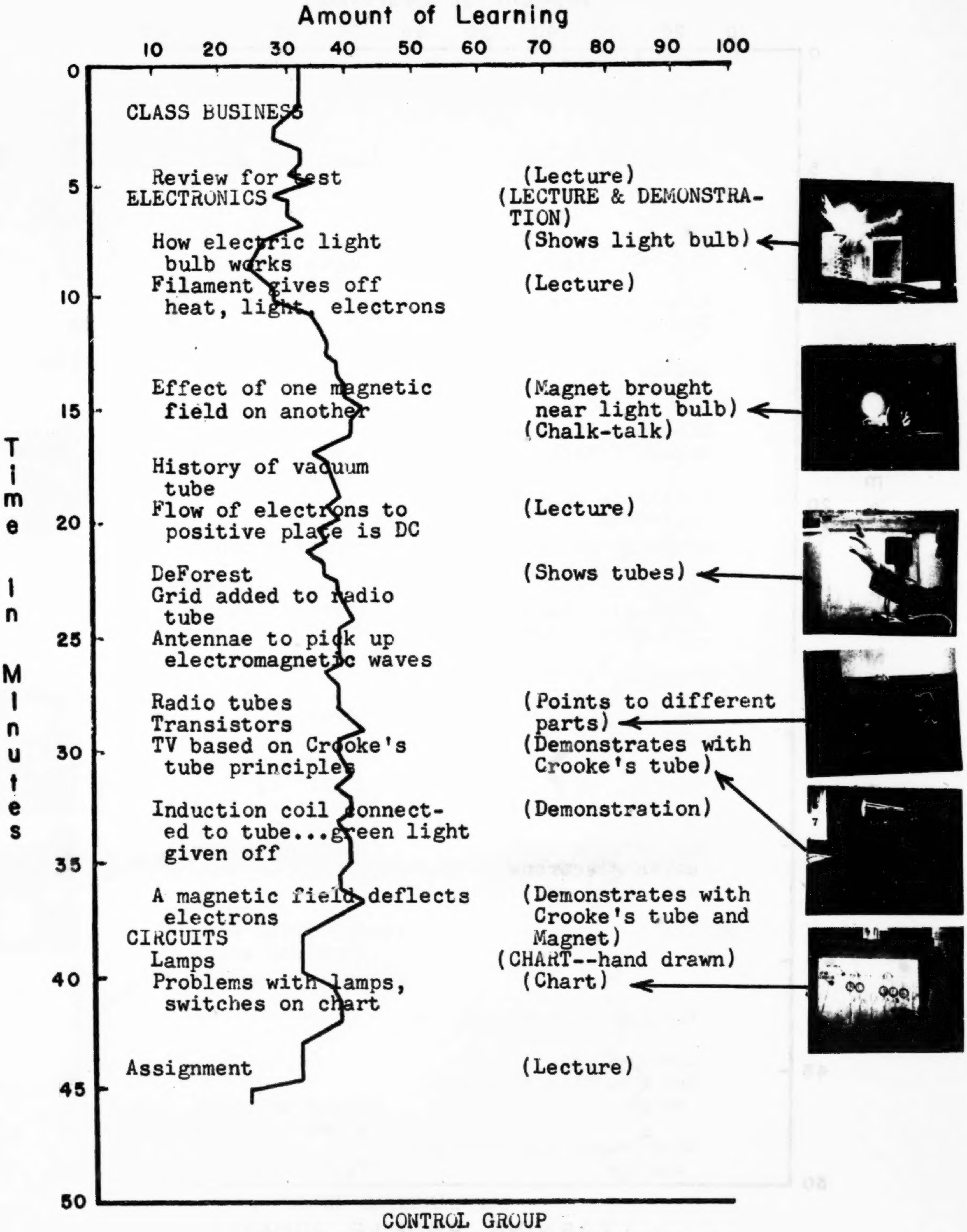
In both groups, a demonstration on radio interference decreased learning (C 213, 40-42 and E 214, 36-37). The demonstration presented no new material for the students to learn.

---

* "Telephone Circuit", Transparency IX, T. 1 & 2, Division of Educational Communications, New York State Education Department, 1961, 10" x 10" slide, two colors.

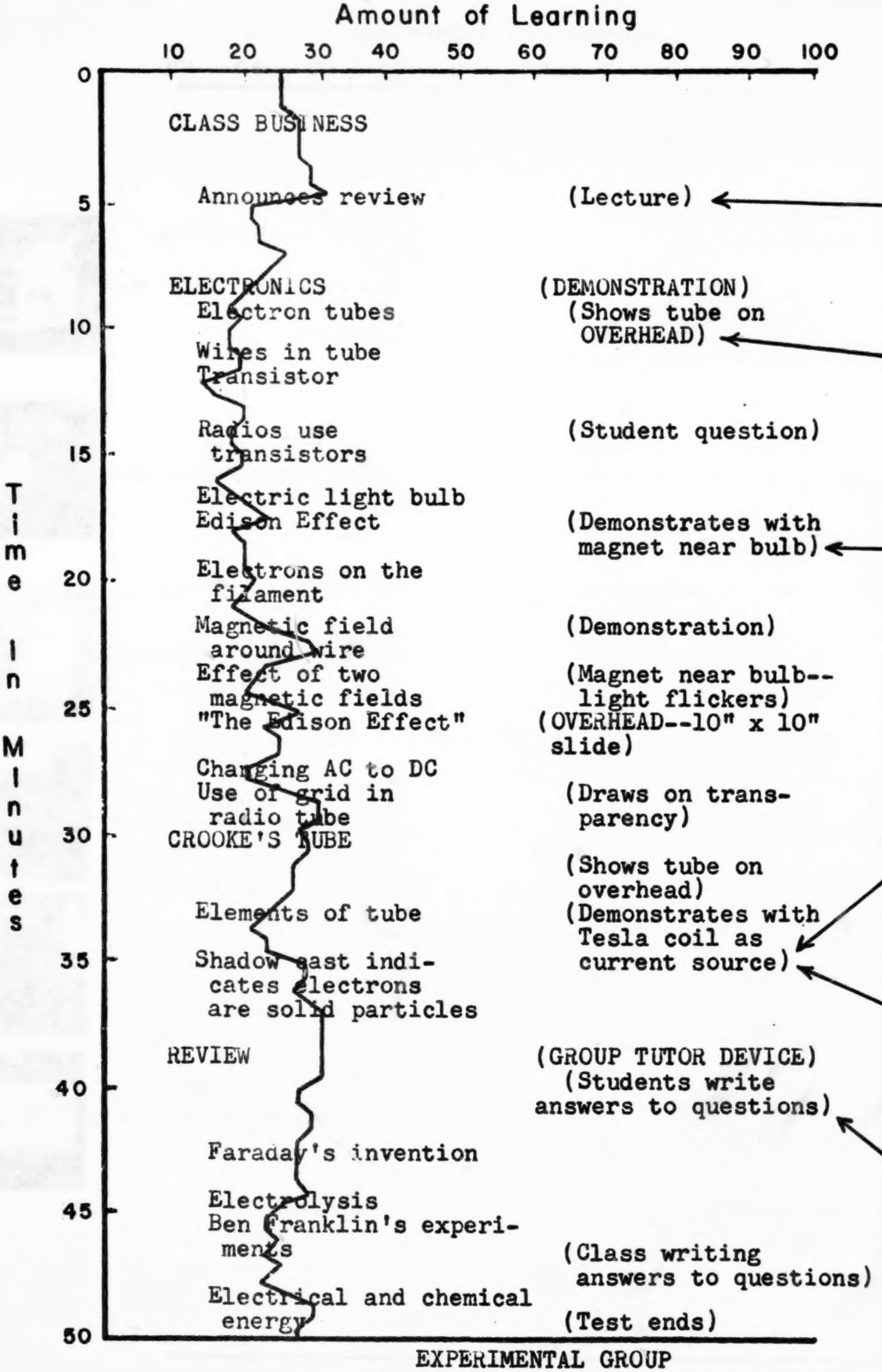
** "One Way Telephone Communication", IX, CC, (Same Source), 1961, 10" x 10" slide, two colors.

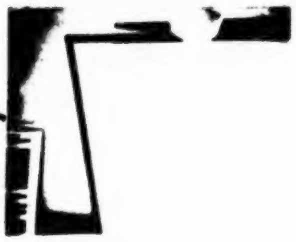
"Radio Waves", IX, BB, (Same Source), 1961, 10" x 10" slide, two colors.



CONTROL GROUP

LEARNING PROFILE NUMBER 215





EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 216

ANALYSIS OF LEARNING PROFILES 215 AND 216

In both groups a demonstration on electronics was conducted, the difference being that in the Experimental Group the overhead projector was used. There was slightly more variation in learning during the Experimental Group. Actual electron tubes shown on the overhead did not result in a significant increase in learning (E 216, 9-13) because the students were already familiar with these objects.

A demonstration of the Edison Effect resulted in an increase in learning (E 216, 18). A slightly greater variation occurred when a graphic explanation was presented by means of an overhead transparency.* In drawing on the acetate transparency to explain the grid of a radio tube, learning increased significantly since this was new information.

Demonstrations of Crooke's Tube and with the Tesla Coil did not affect learning significantly because the students did not realize the full implications of these demonstrations. Interviews with students also revealed that learning did not increase as much as may have been expected during the demonstration of the Edison Effect because some of them did not understand it fully.

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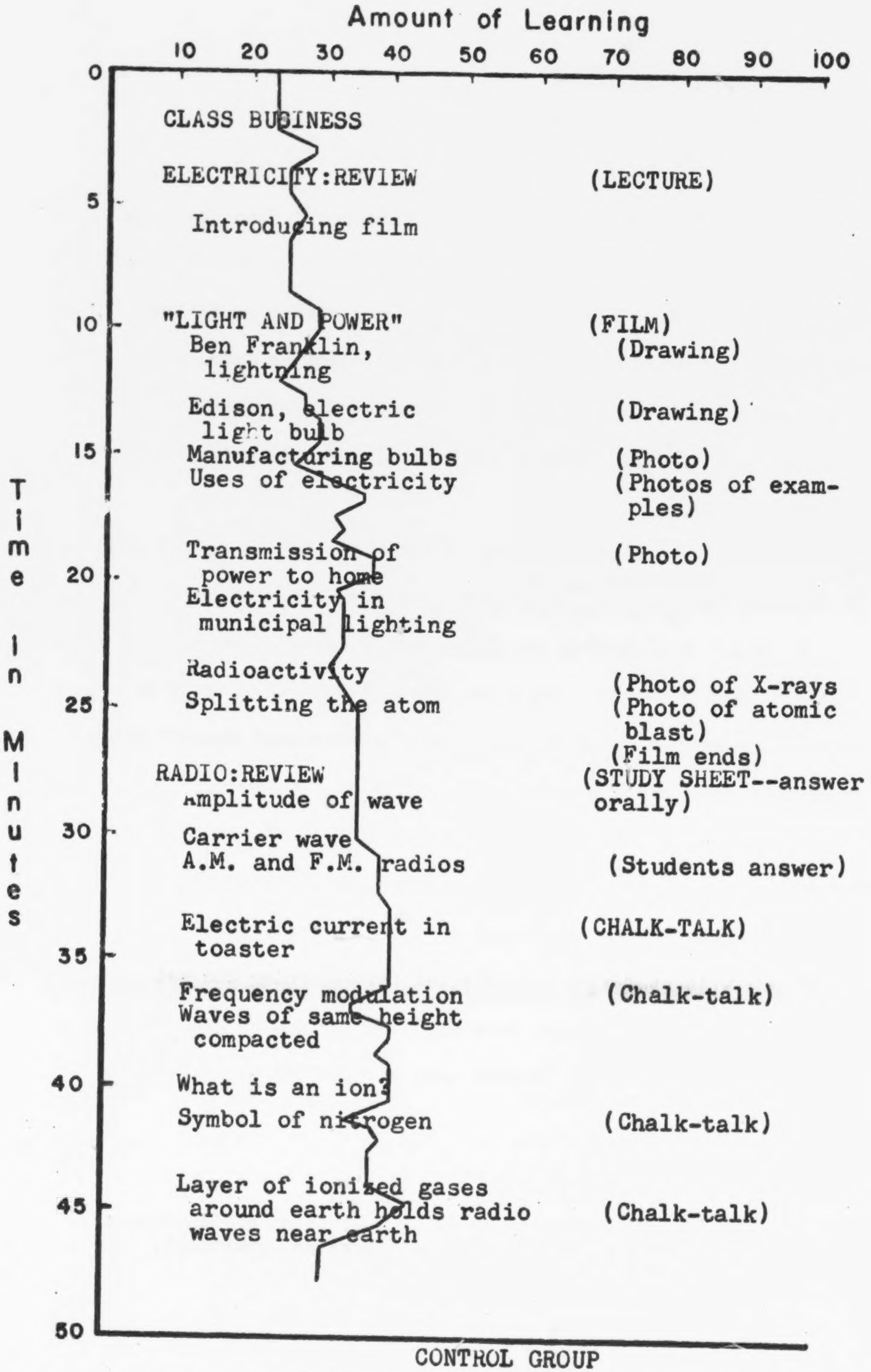
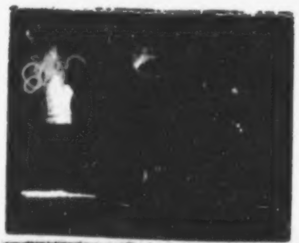
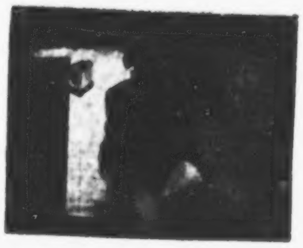
* "Edison Effect", Transparency IX. U., Division of Educational Communications, New York State Education Department, 1961. 10" x 10" slide, two colors.

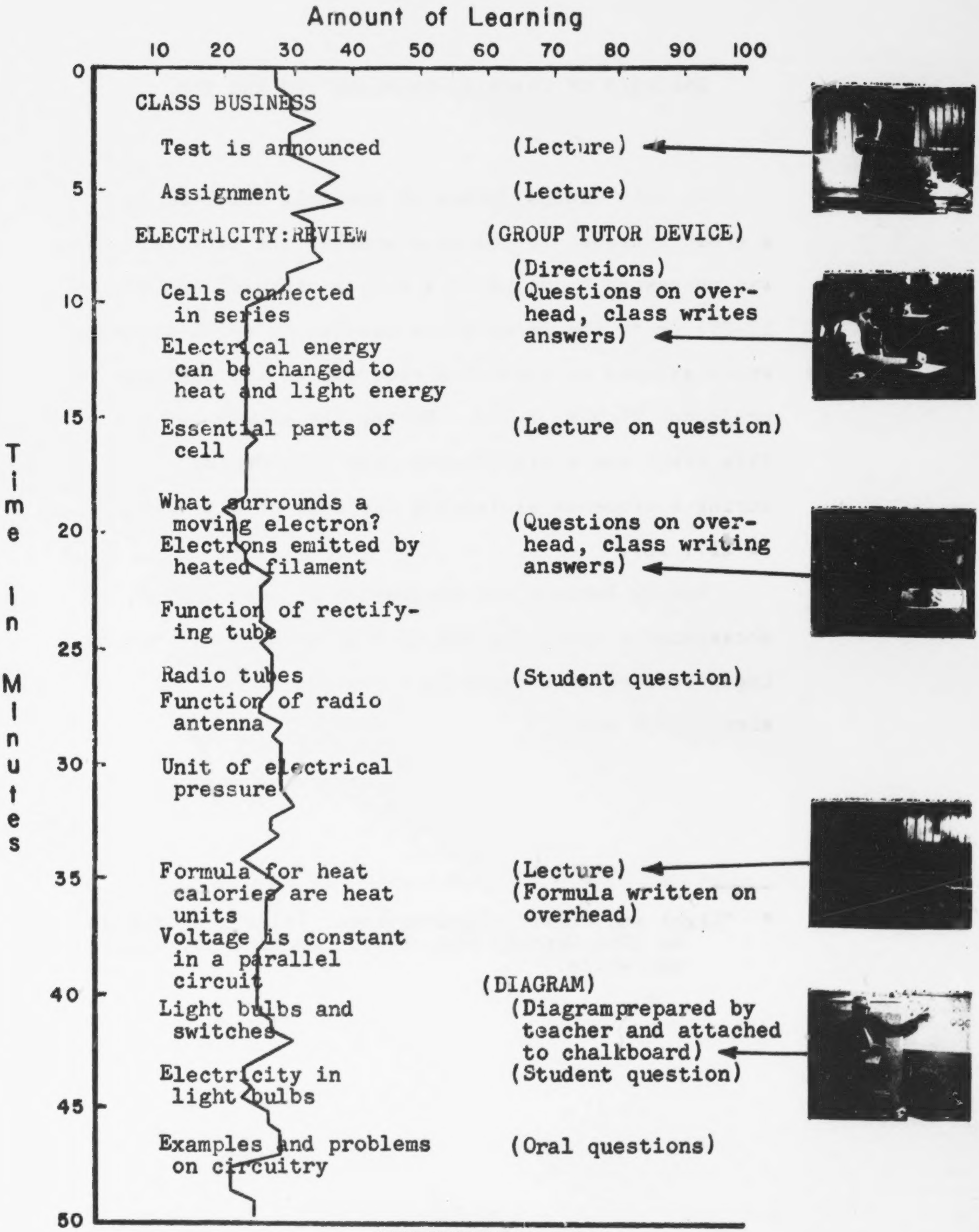






CONTROL GROUP

LEARNING PROFILE NUMBER 217



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 218

ANALYSIS OF LEARNING PROFILES 217 AND 218

In both groups review of the unit resulted in a great increase in learning whether the material was presented by means of a motion picture* (C 217, 10-27) or by the group tutor device, by which students wrote answers to questions recorded on the overhead projector (E 218, 8-30). During the showing of the film there was a significant peak in learning during a sequence explaining the uses of electricity (C 217, 16).

During lecture and discussion in both groups, occasionally involving use of the chalkboard, learning preceeded at a relatively even level with no significant peaks.

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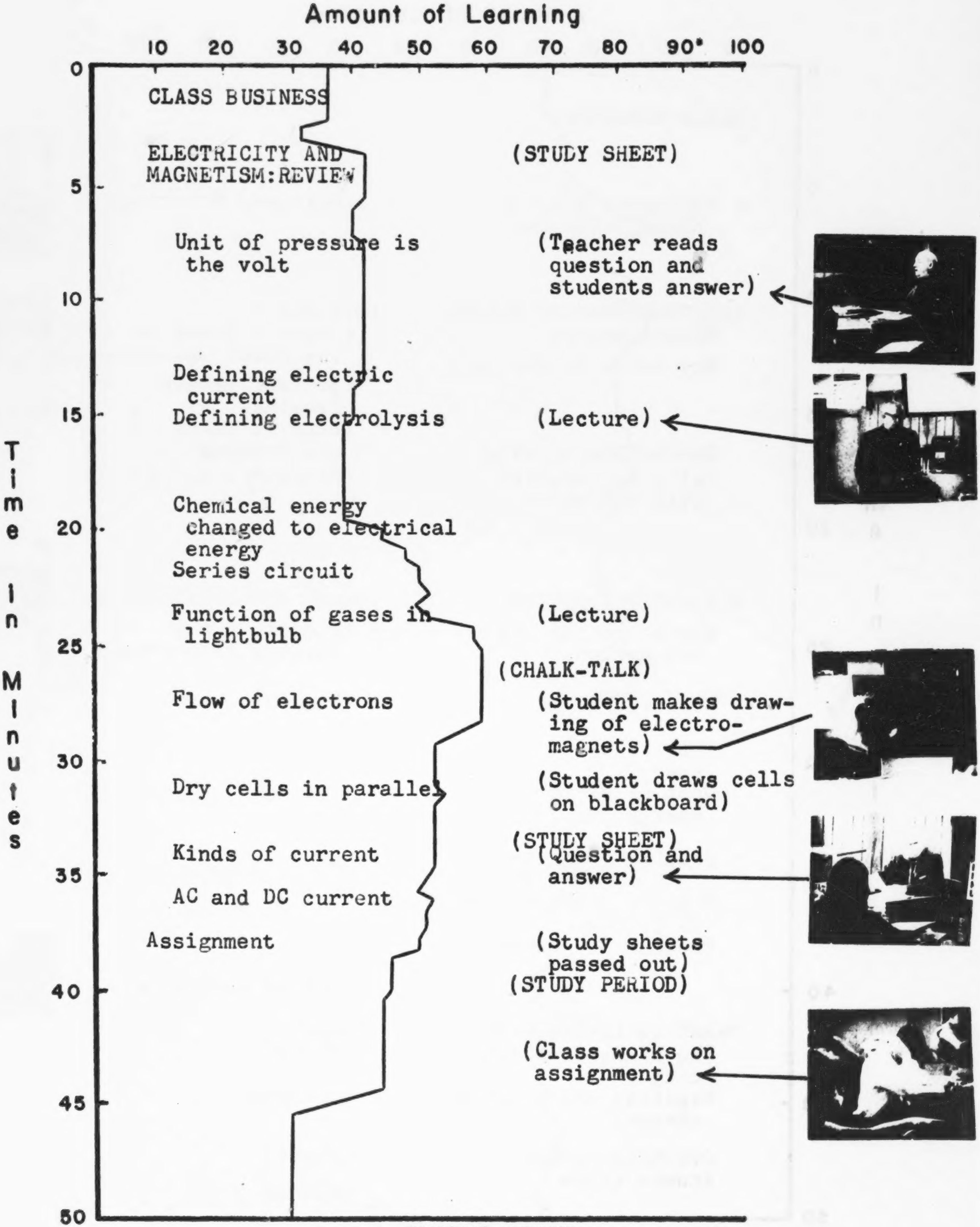
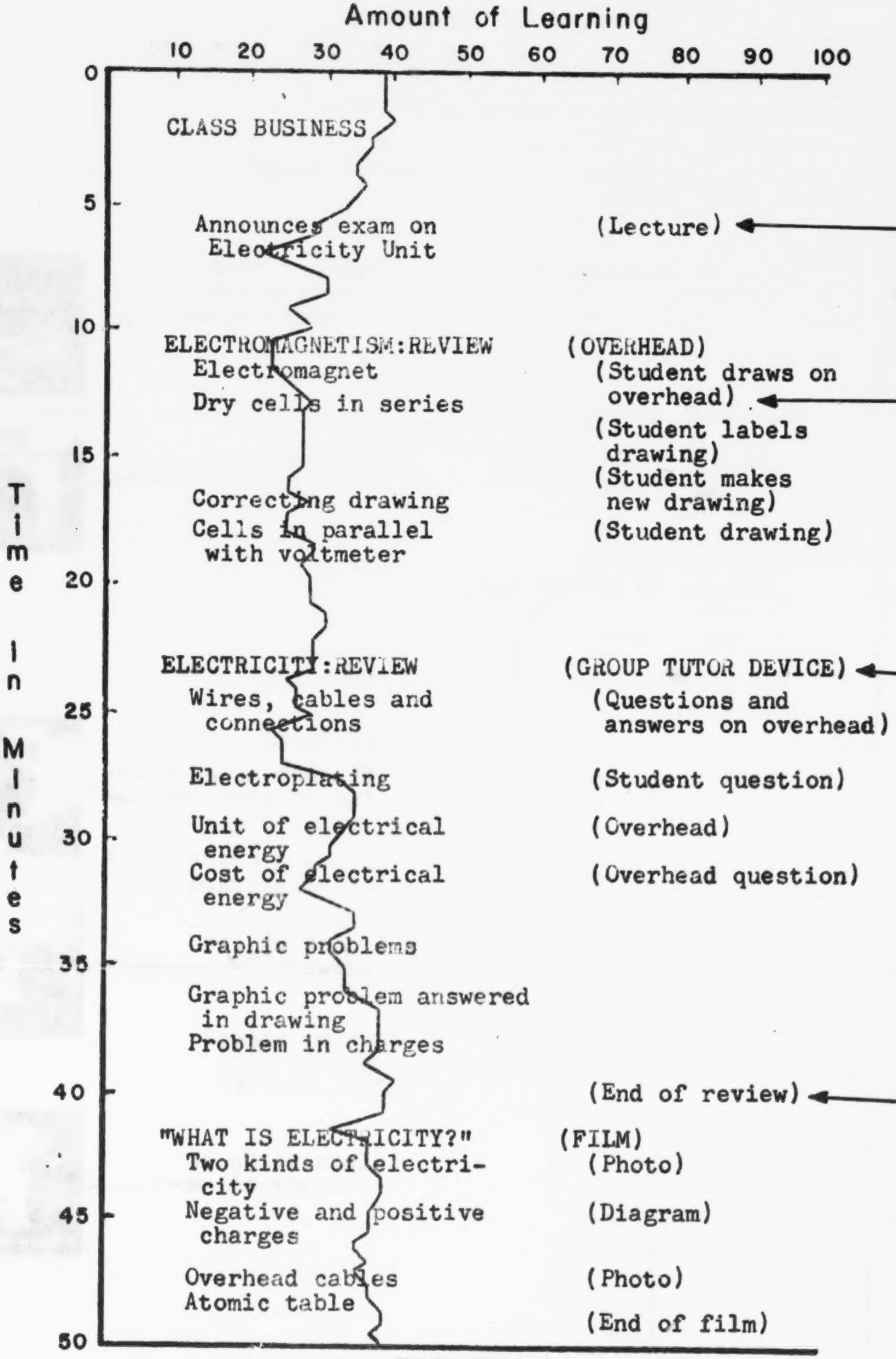
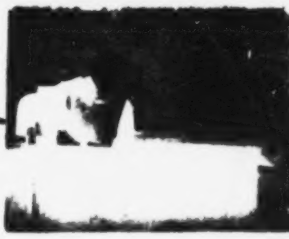
* "Light and Power", Instructional Films , produced by 20th Century Fox, 1947. 22 minutes, black and white.

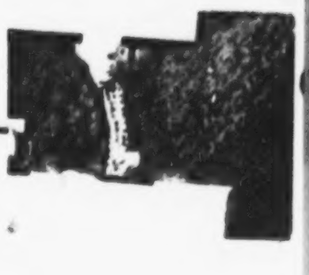


CONTROL GROUP

LEARNING PROFILE NUMBER 219







EXPERIMENTAL GROUP

V-1387 LEARNING PROFILE NUMBER 220

ANALYSIS OF LEARNING PROFILES 219 AND 220

Lecture in the Control Group resulted in a lower number of variations in learning with lecture and study by means of a study guide, thus being revealed as less effective than class study by means of the newer media.

In the Control Group there was a relatively large increase of learning for that group when the instructor made a chalkboard drawing (C 219, 25-27). As soon as the content in the class moved into an area which had previously been taken up, the level of learning dropped, even though in this case the procedure used was also a chalkboard drawing.

Although a review of the general pattern revealed no great variations in learning, there was some variation as the group viewed on the screen drawings made by students with grease pencil on the overhead. There were great variations, however when a carefully planned review by means of a group tutor device occurred. The highest point in this presentation was reached by a portion where problems were presented and then answered.

In spite of the fact that it was the third time the group had seen a film on electricity*, the level of learning did not drop.

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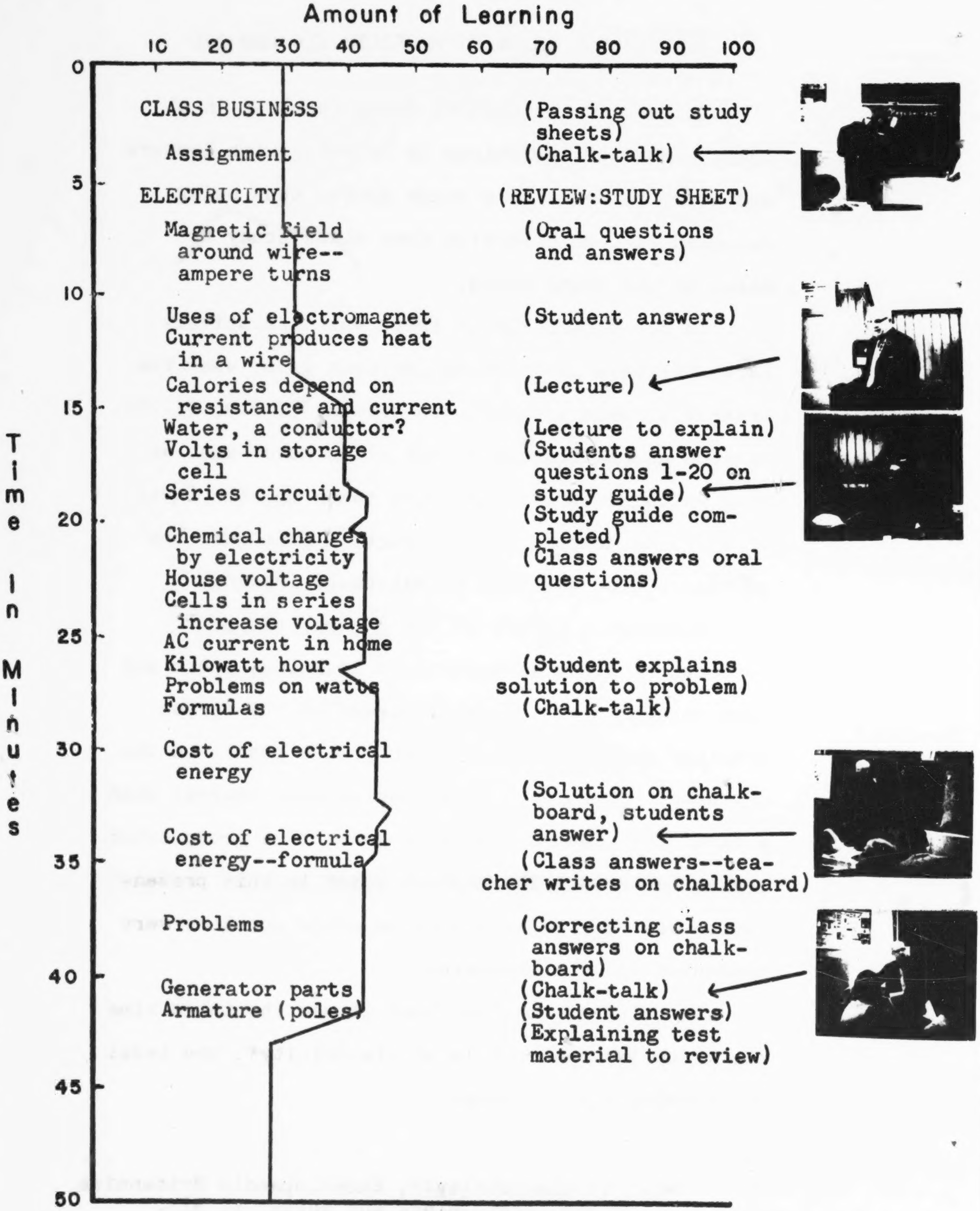
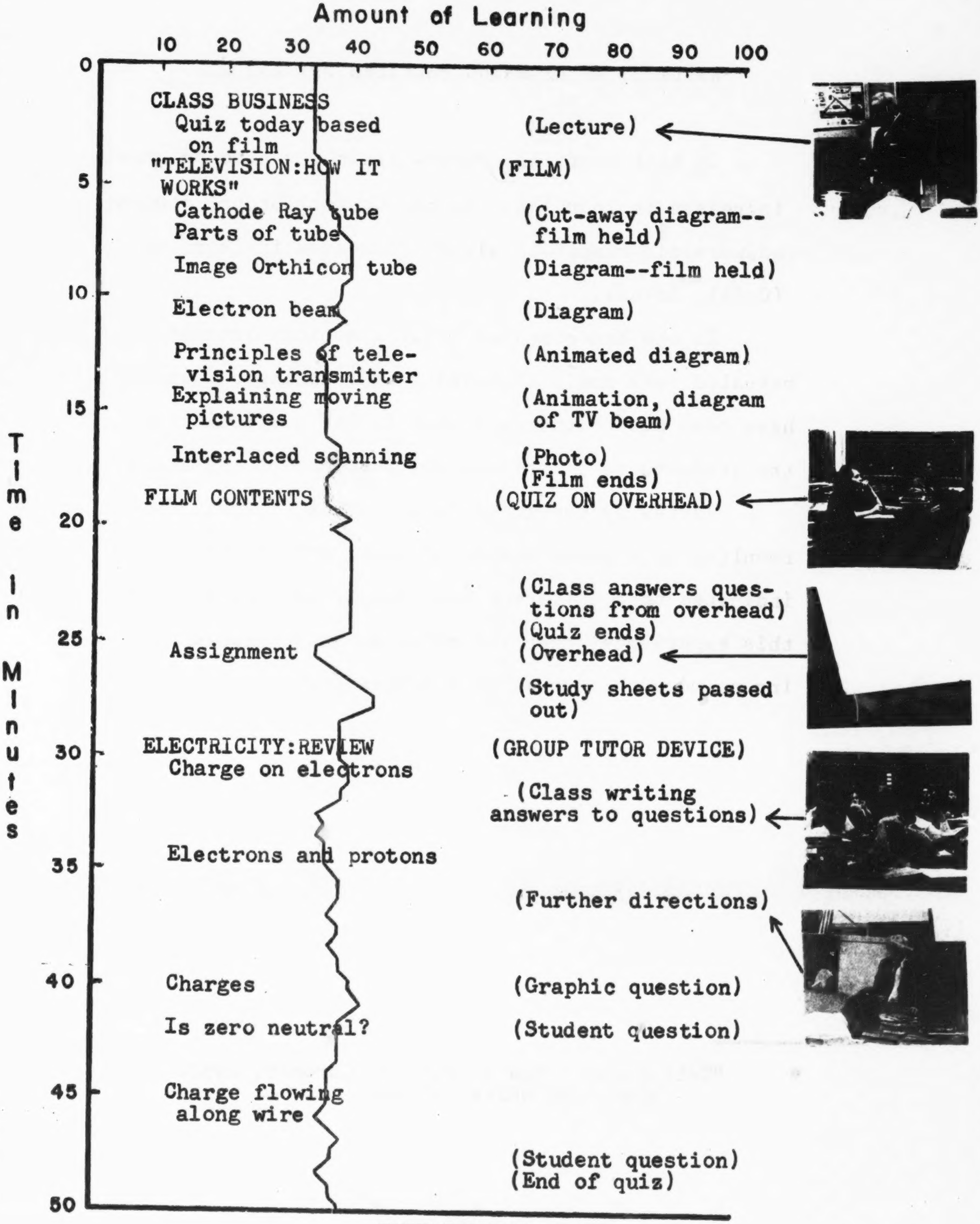
* "What is Electricity?", Encyclopaedia Britannica Films, 1943, black and white, 11 min.



CONTROL GROUP
LEARNING PROFILE NUMBER 221



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 222

ANALYSIS OF LEARNING PROFILES 221 AND 222

In both profiles, review again revealed no great increases in learning. In the Control Group, student answers did result in slight decreases in learning (C 221, 26-42).

In the Experimental Group a motion picture* revealed very small increments in learning. This may have been due to the fact that it was difficult for the students to understand the information presented.

Review by the group tutor device (E 222, 30-48) resulted in a great number of small variations which indicated that different individuals were gaining from this experience, that the group as a whole were gaining no more than usual in a review period.

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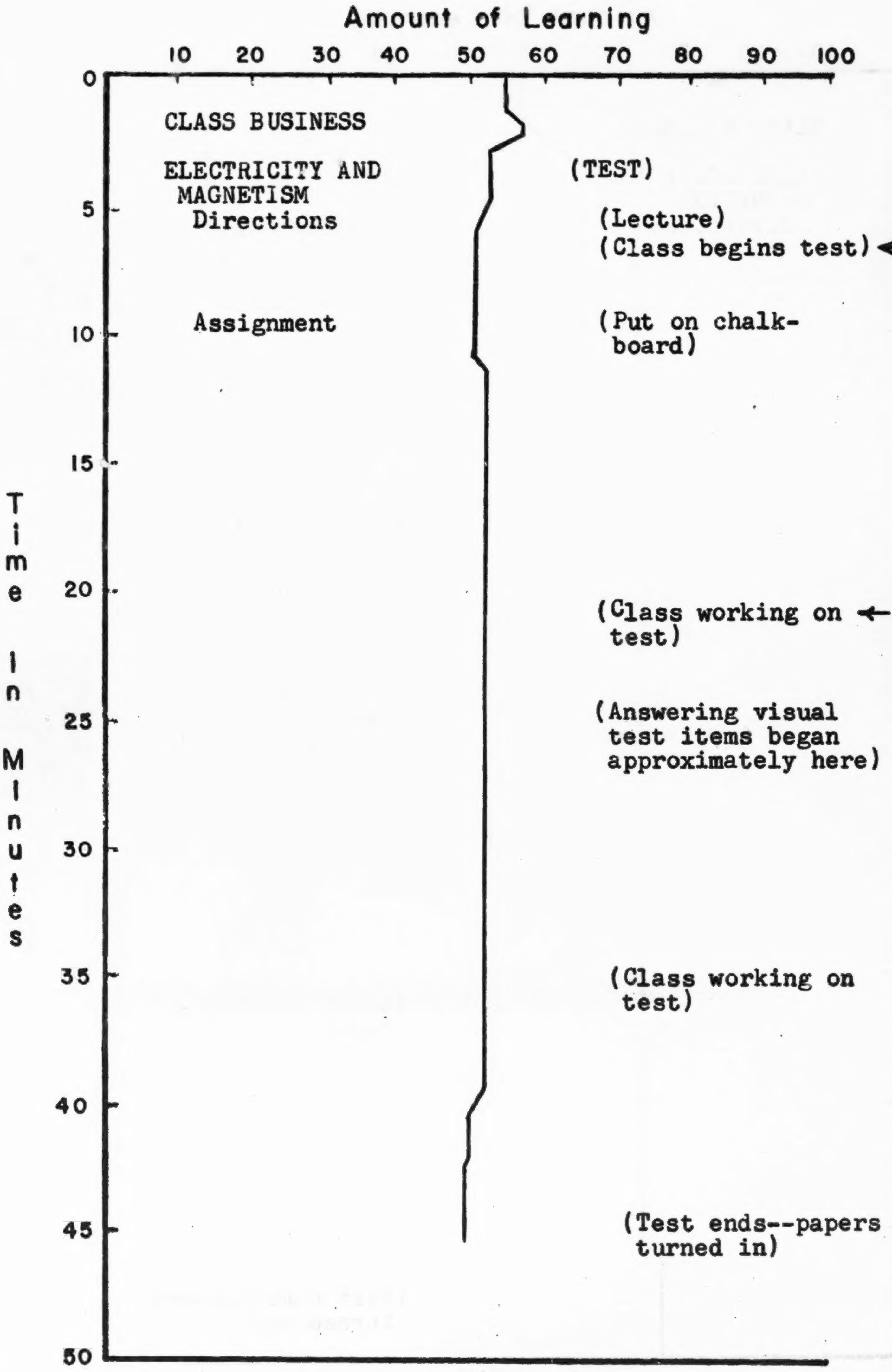
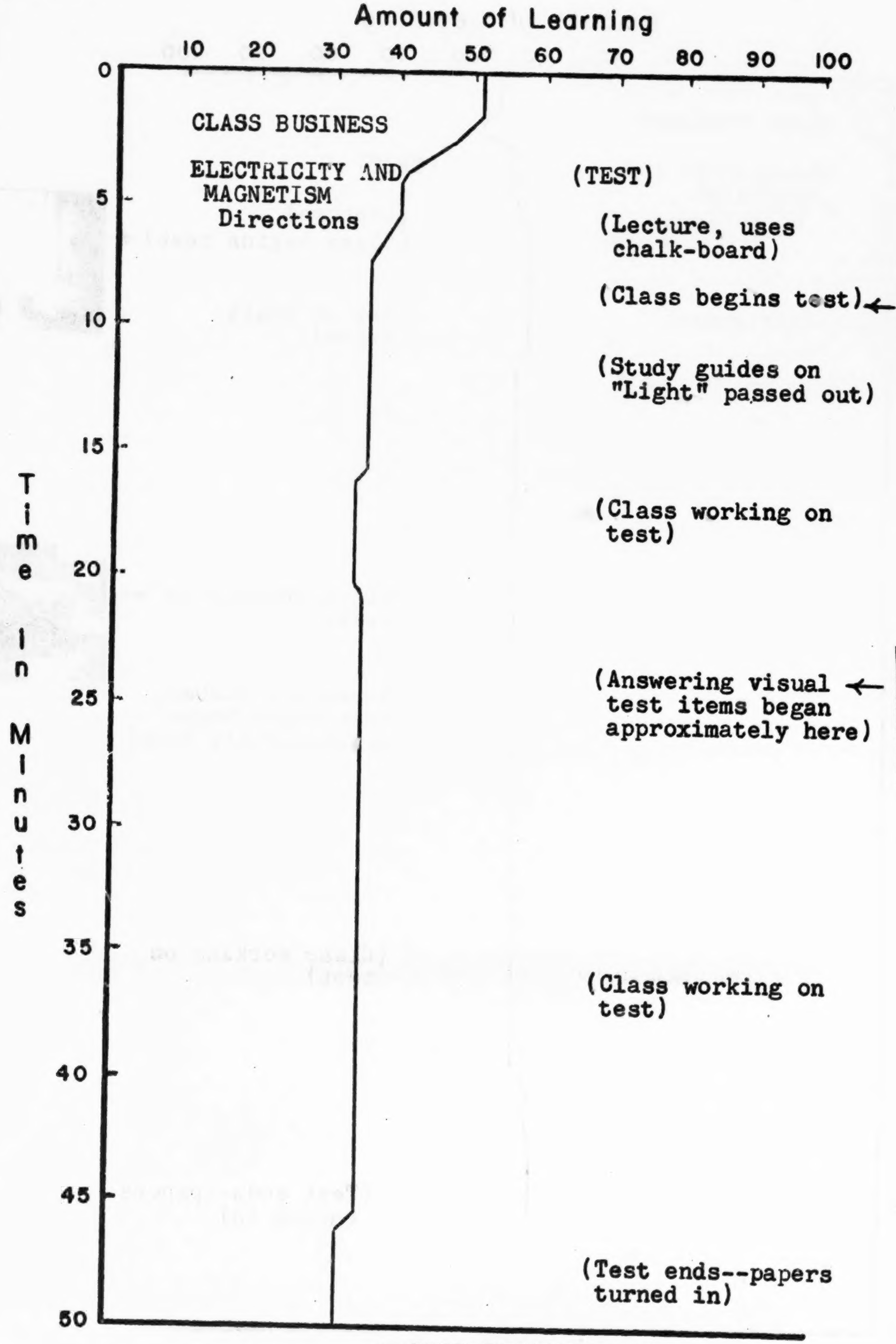
* "Television: How it Works", Coronet, 1952. Black and white, 10 min.



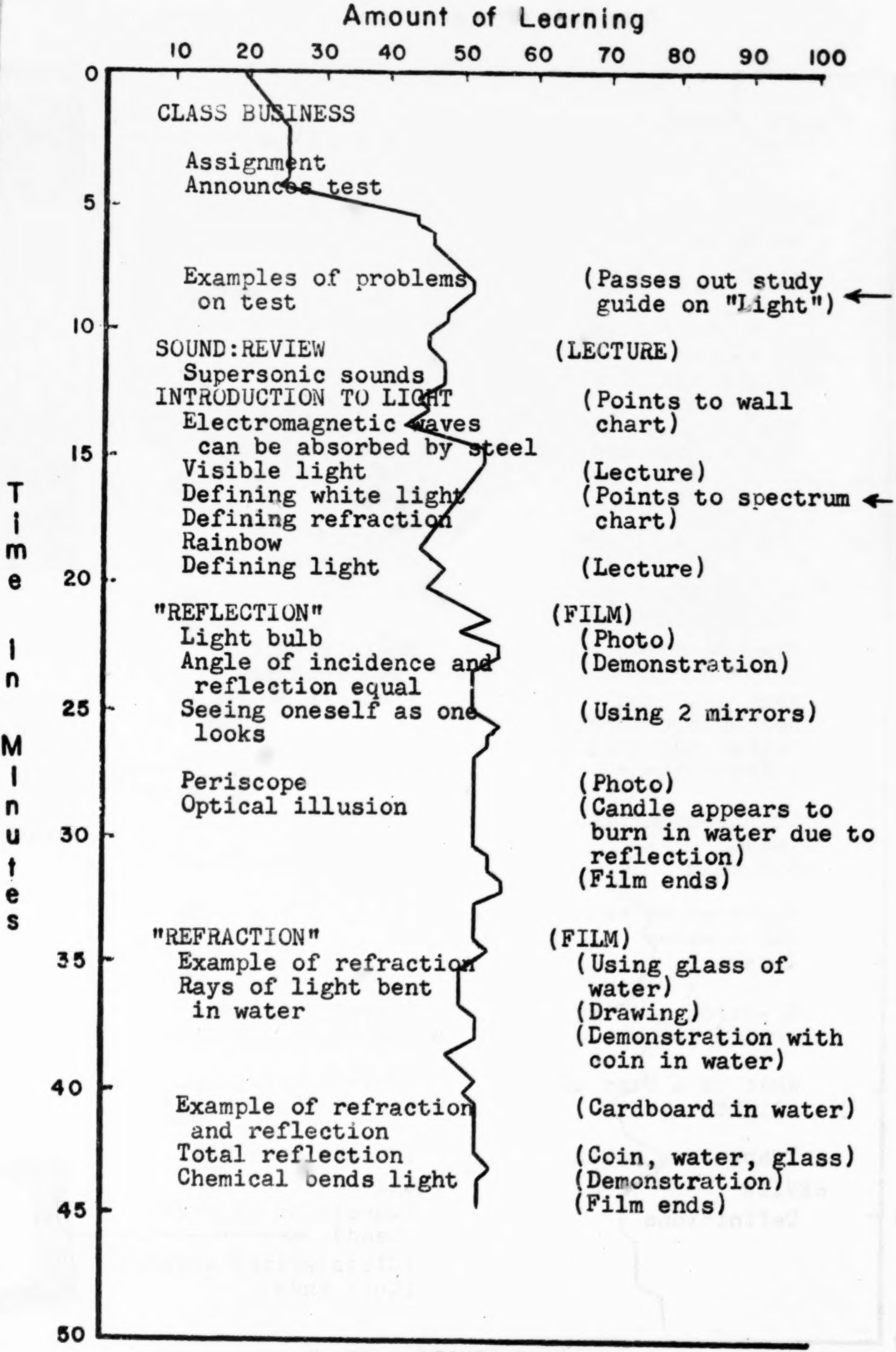
CONTROL GROUP

LEARNING PROFILE NUMBER I



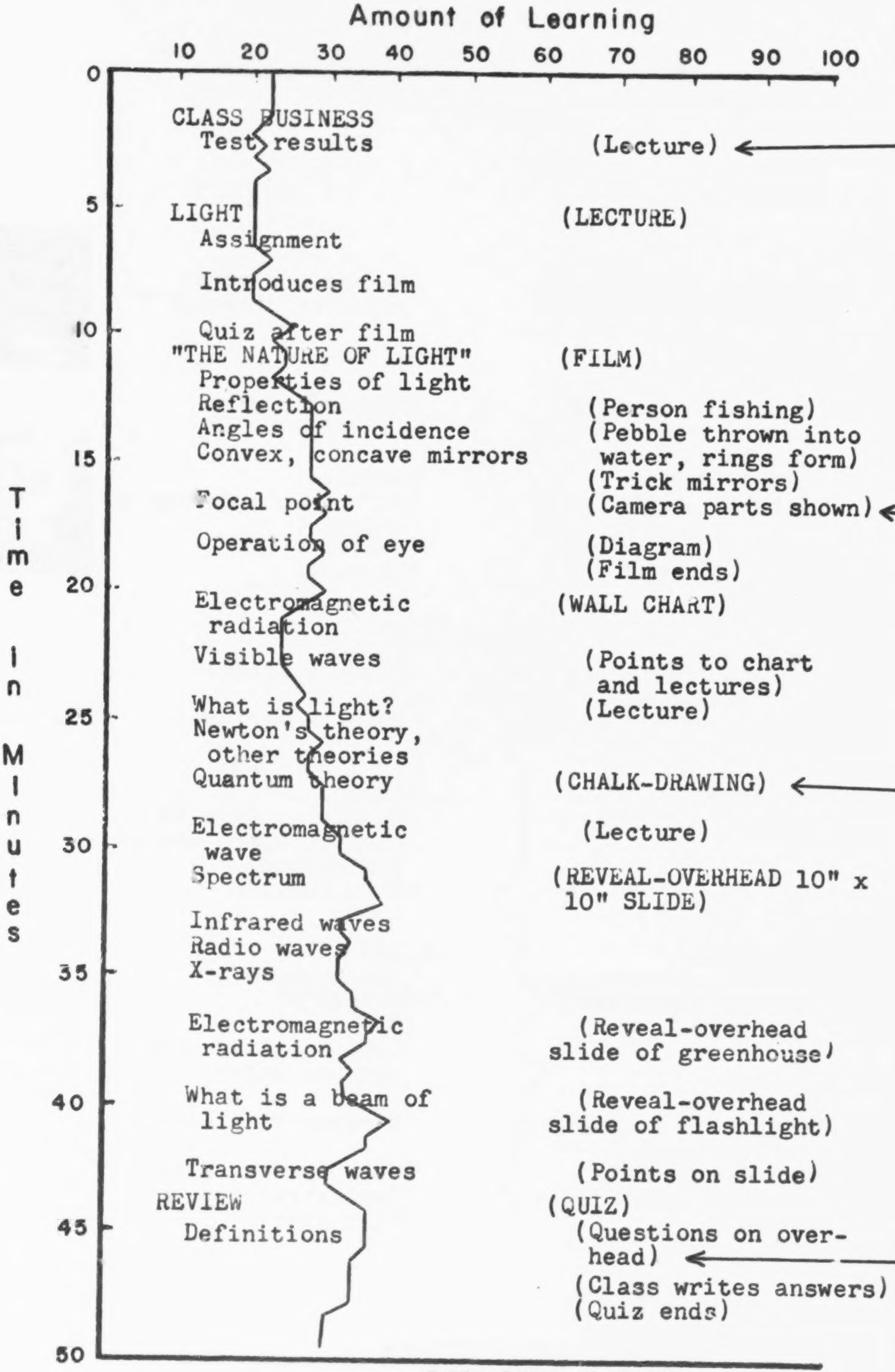
EXPERIMENTAL GROUP

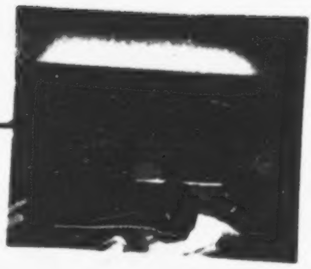
LEARNING PROFILE NUMBER J

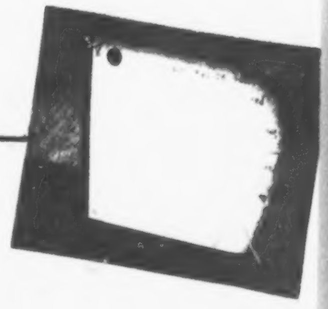


CONTROL GROUP

LEARNING PROFILE NUMBER 223







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 224

ANALYSIS OF LEARNING PROFILES 223 AND 224

In both the groups, motion picture films were utilized to present the same information. In the Control Group the films were presented in their usual pattern by being shown without comment, one after another. Both the first film* and the other film** showed no great variations in learning. This was also true when one of the films* was presented without being stopped at a later date (E 228, 38-48). It was also revealed in the Experimental Group where yet another film*** was shown without being stopped and without accompanying discussion questions during the films (E 224, 11-19).

Use of a wall chart in the Control Group did cause an increase in learning (C 223, 15) whereas lecture in reference to the same chart in the Experimental Group resulted in decrease in learning (E 224, 21), although explanation and chalk drawing caused some increases as the chart was discussed by the teacher.

---

* "Reflection", McGraw-Hill Co., 1955. Black and white, 9 min.

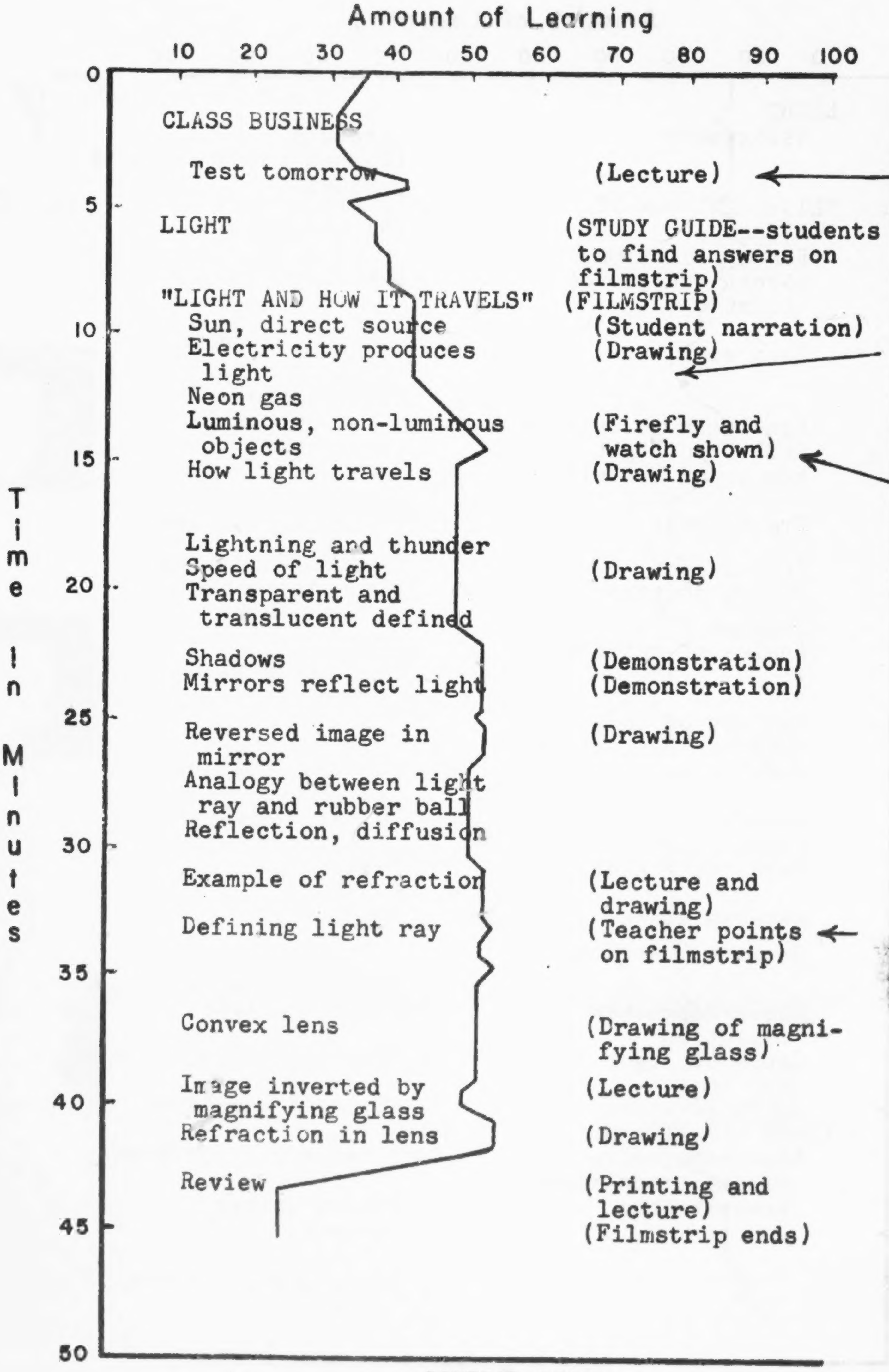
** "Refraction", McGraw-Hill Co., 1955. Black and white, 9 min.

*** "Nature of Light", Coronet, 1958. Black and white, 10 min.

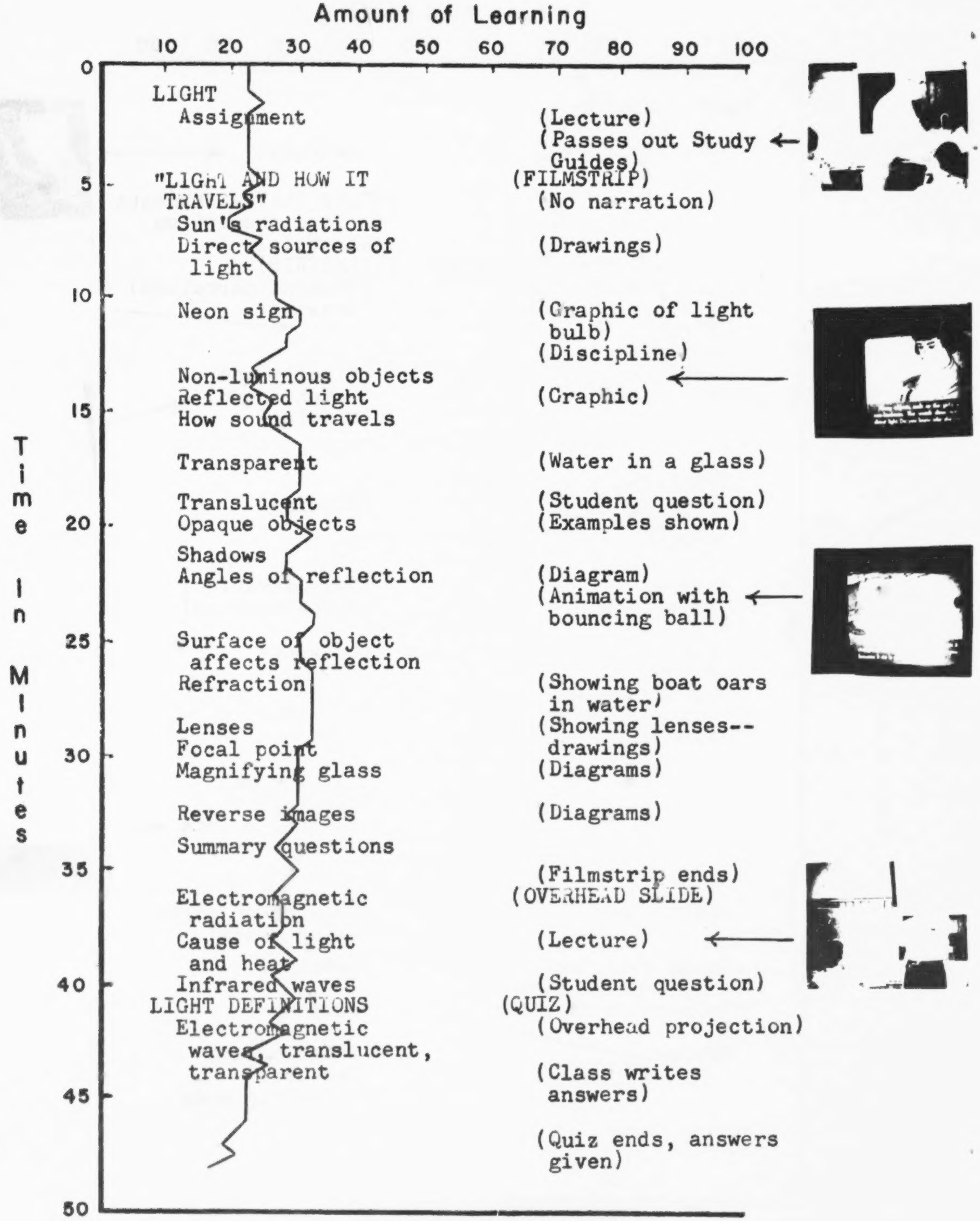
An overhead transparency# on the same topic resulted in a peak of learning (E 224, 32). Learning also reached a peak with the use of a teacher-made transparency, and a peak also resulted with the showing of another overhead transparency (E 224, 40).

Where normally a quiz would have resulted in a pronounced decrease, a quiz presented on the overhead projector brought a small peak of learning (E 224, 45).

"Electromagnetic Radiations", Technifax, n.d. Multi-colored, 8" x 10" slide.



CONTROL GROUP
LEARNING PROFILE NUMBER 225



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 226

ANALYSIS OF LEARNING PROFILES 225 AND 226

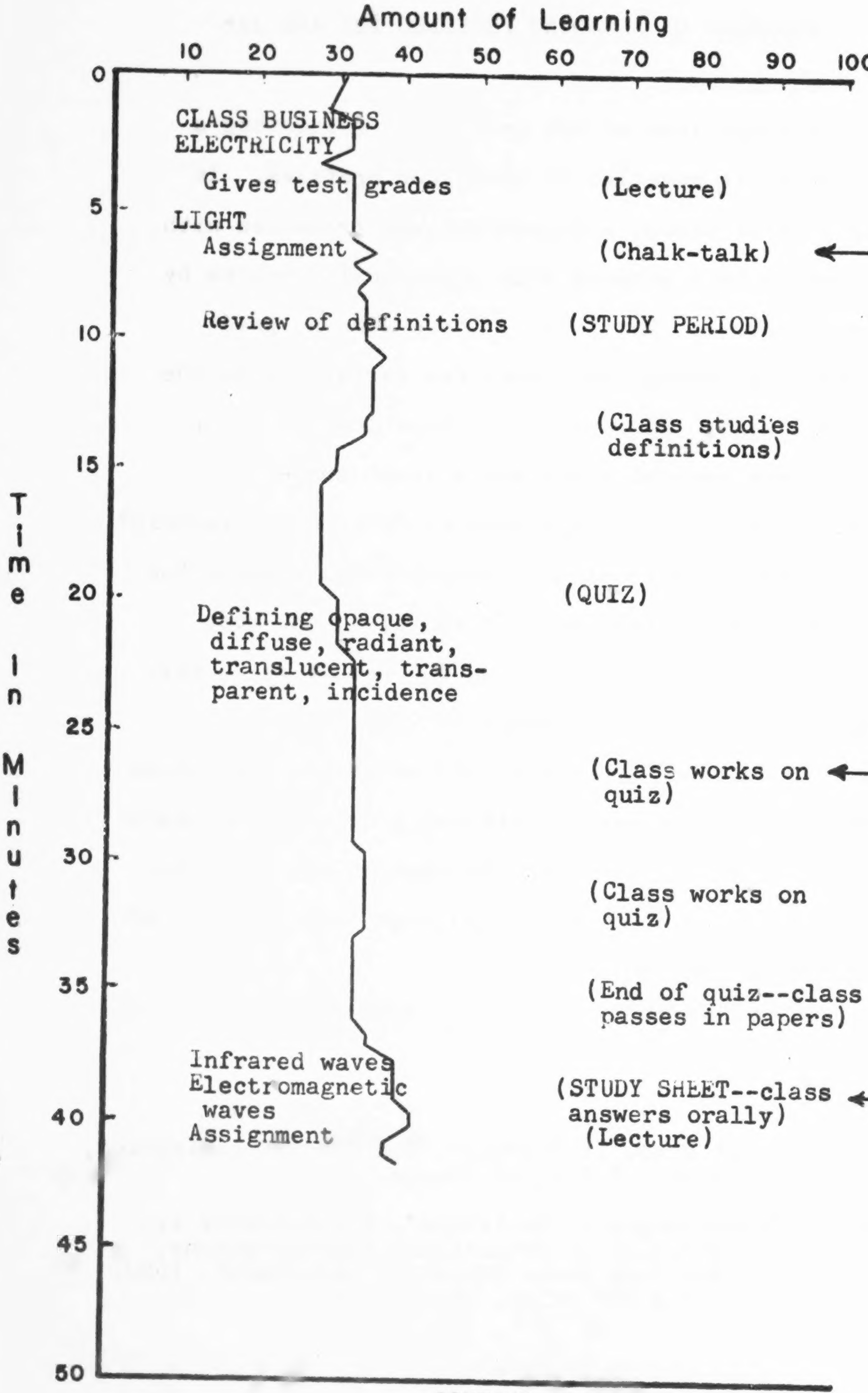
A comparison of two methods of presenting a filmstrip is revealed in these two profiles. In the Control Group, a filmstrip* was presented with narration by a student with occasional comments by the teacher (C 225, 8-45). There were no great peaks of learning and a very few variations in the Control Group, whereas in the Experimental Group there were several peaks and a great number of variations. In the Experimental Group the filmstrip* was presented without any narration and without the comments by the teacher. In addition, the most significant level of learning the result was a saving of time of seven minutes (E 226, 5-35).

An overhead transparency** which had been shown previously was presented without a decrease in learning which would have been the case if the presentation of review information had been done by means of lecture (E 226, 36).

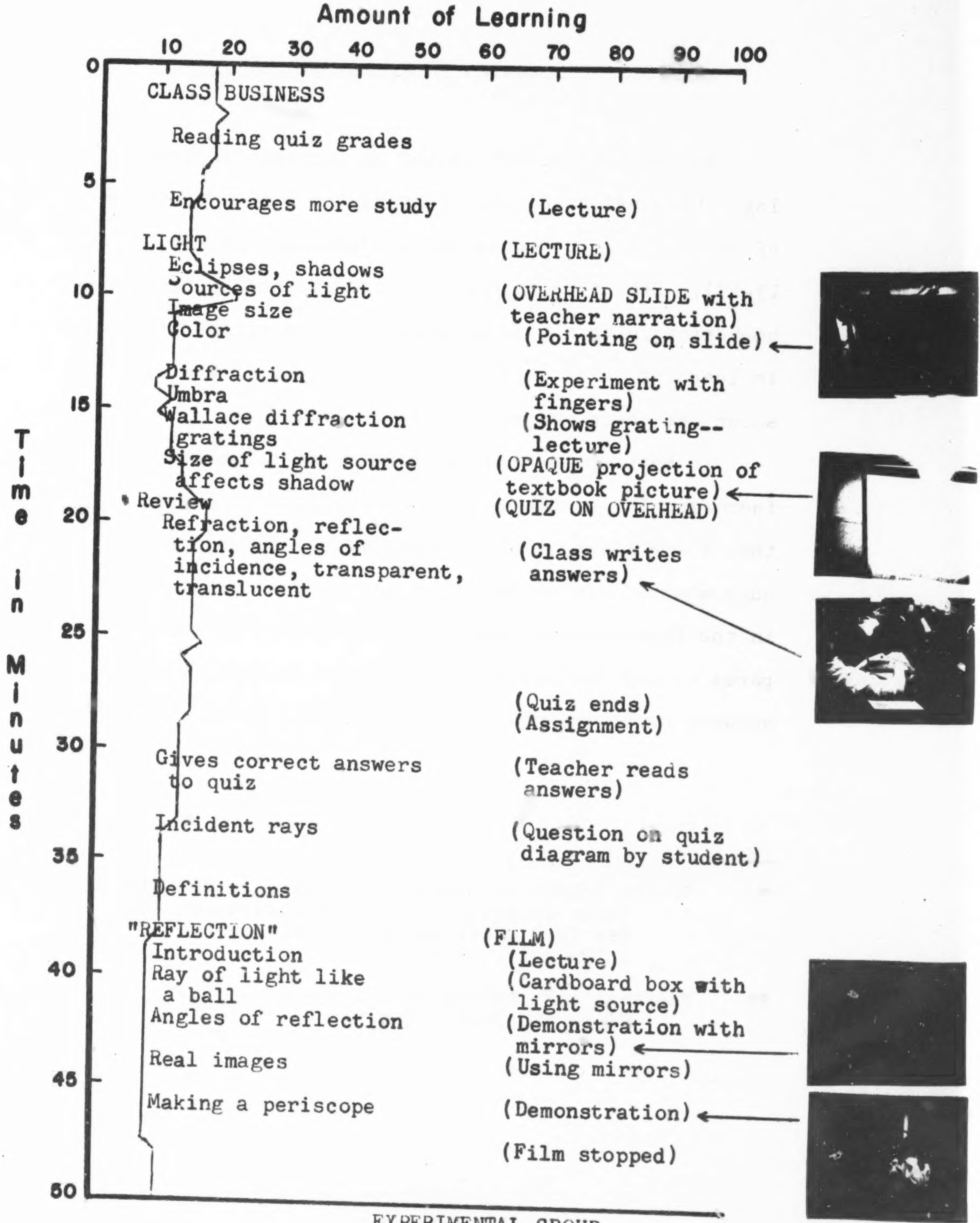
---

* "Light & How It Travels", Jam Handy Organization, 1959. Color, 45 frames.

** "Electromagnetic Radiation", Transparency X., Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.



CONTROL GROUP
LEARNING PROFILE NUMBER 227



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 228

ANALYSIS OF LEARNING PROFILES 227 AND 228

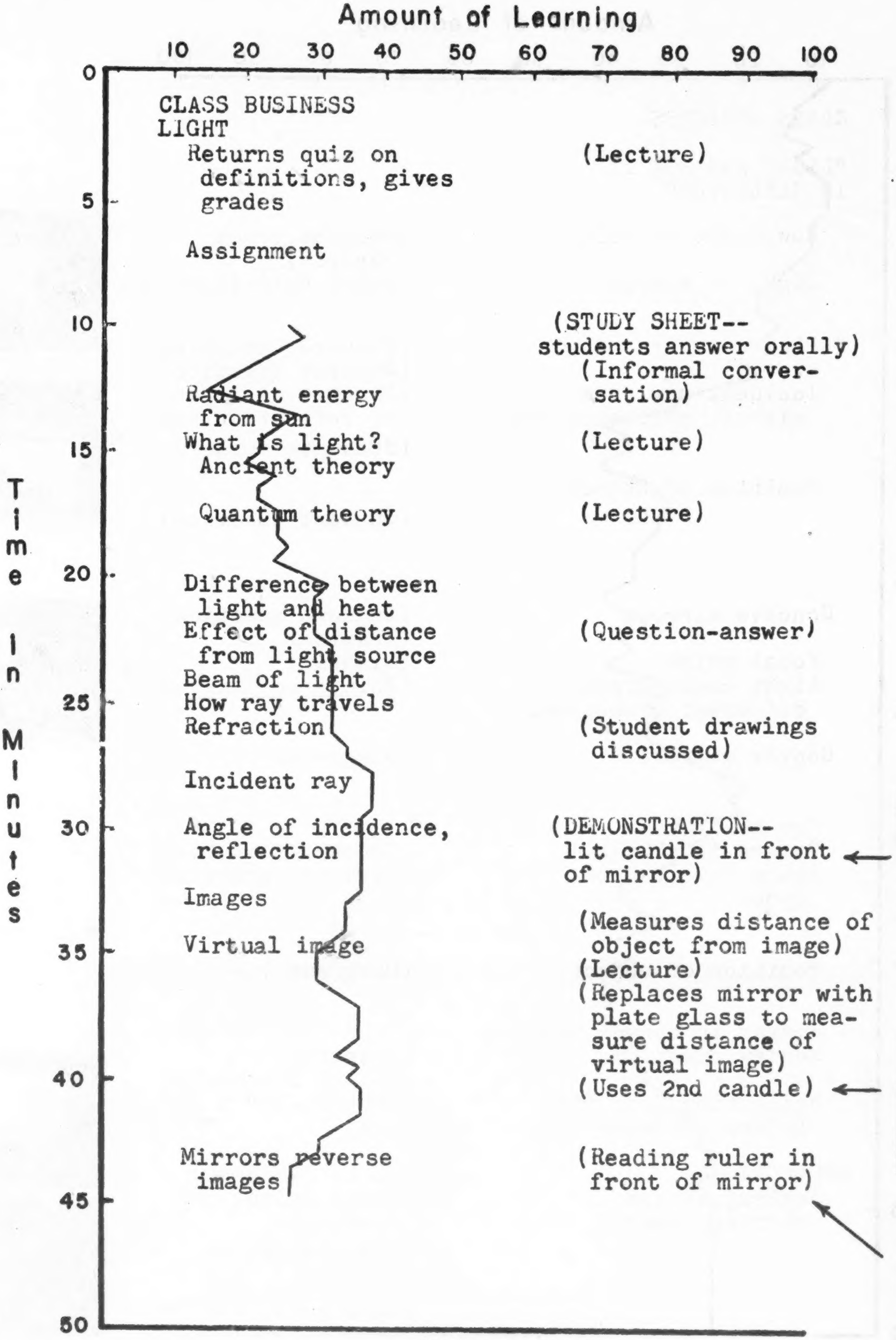
An overhead slide* caused an increase in learning. Discussion and use of hands for a demonstration of grading led to decreases in learning. (E 228, 13-17). Use of an opaque projector to show a textbook picture to the group showed only a slight increase in learning. The motion picture of this film** was shown but there was no profile record of it.

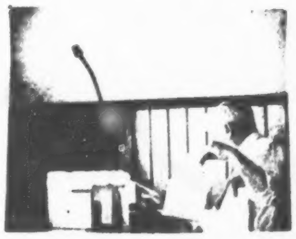
In both groups a quiz produces no significant increases in learning. It is significant, however, that a small amount of time was required for the quiz when it was projected on an overhead projector in the Experimental Group (E 228, 19-28), as compared to the Control Group where the students wrote answers on a mimeographed sheet (C 227, 19-35).

---

* "Point Source of Light", Transparency XG, Division of Educational Communications, 1960. New York State Education Department, 10" x 10" slide, 2 colors.

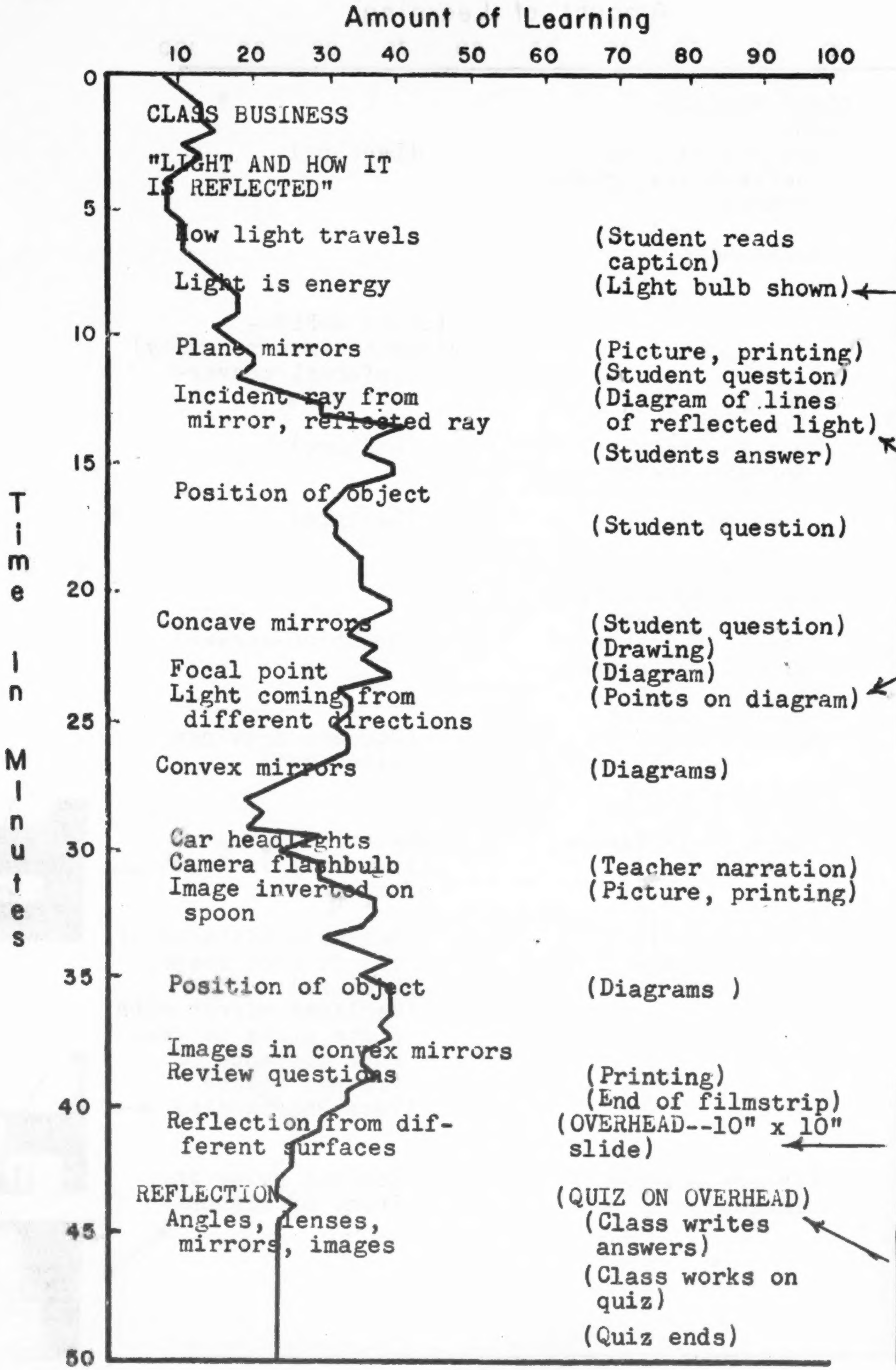
** "Reflection", McGraw-Hill Company, 1955. Black and White, 9 min.

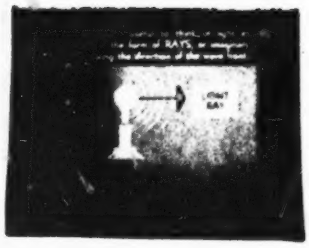


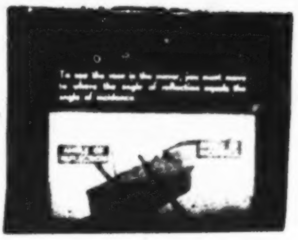


CONTROL GROUP

LEARNING PROFILE NUMBER 229







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 230

ANALYSIS OF LEARNING PROFILES 229 AND 230

Learning during a filmstrip* did not increase until new information was presented (E 230, 13) and from this point on, learning was maintained at a high level until diagrams of information which was familiar to the students was introduced. However, when an application of this information was presented, learning again increased.

There were some increases in learning during a discussion of answers to a study sheet (C 229, 13-28). A demonstration of the same information which had caused an increase in learning in the Experimental Group (E 230, 13) did not result in increases in learning. Since the information in both groups was similar it could be assumed that the filmstrip was much more effective than the demonstration which also took more time. (C 229, 30-34).

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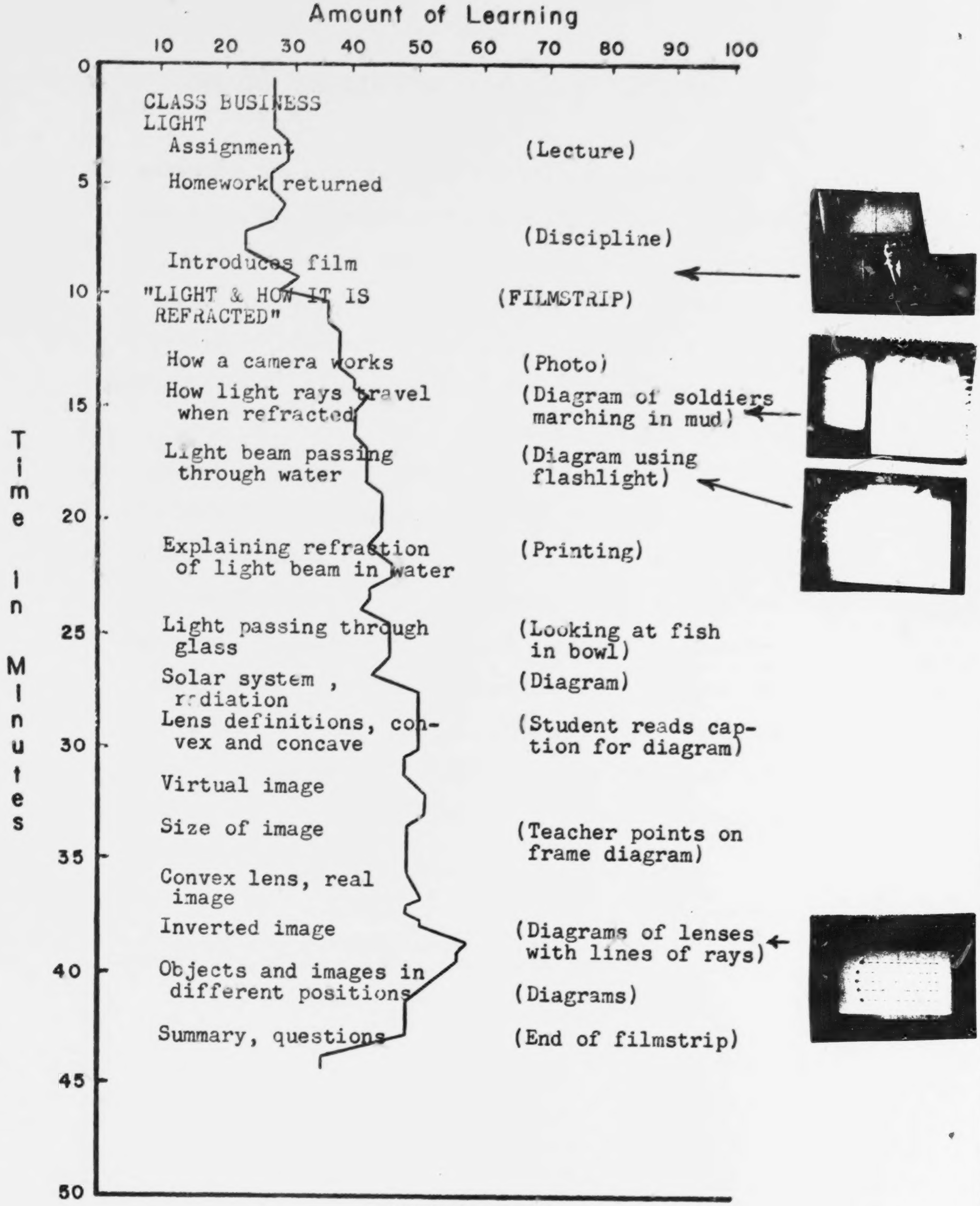
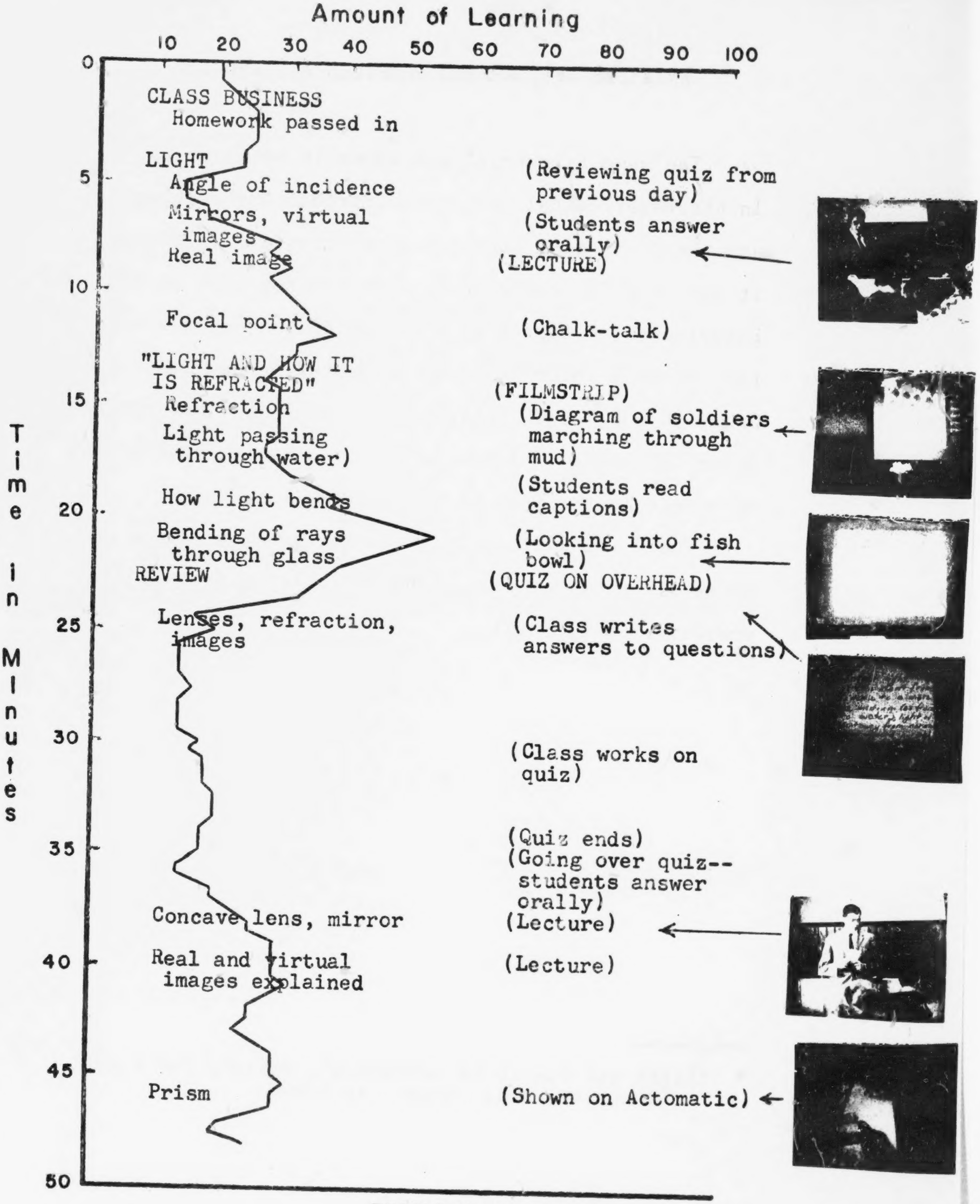
* "Light and How It Is Reflected", Society for Visual Education, n.d.. Color, 59 frames.



CONTROL GROUP

LEARNING PROFILE NUMBER 231

7



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 232

ANALYSIS OF LEARNING PROFILES 231 AND 232

The same filmstrip* was shown in both groups. In the Experimental Group the introductory portion and the concluding portions were omitted. This made it possible for concentration on the key part of the Experimental Group (E 232, 21) which was not the case for the same information as presented in the Control Group (C 231, 25). Following a quiz in the Experimental Group increases in learning resulted as interpretations were made in the form of a lecture.

There was also an increase in learning when a prism was shown bending light on an Actomatic projector (E 232, 45).

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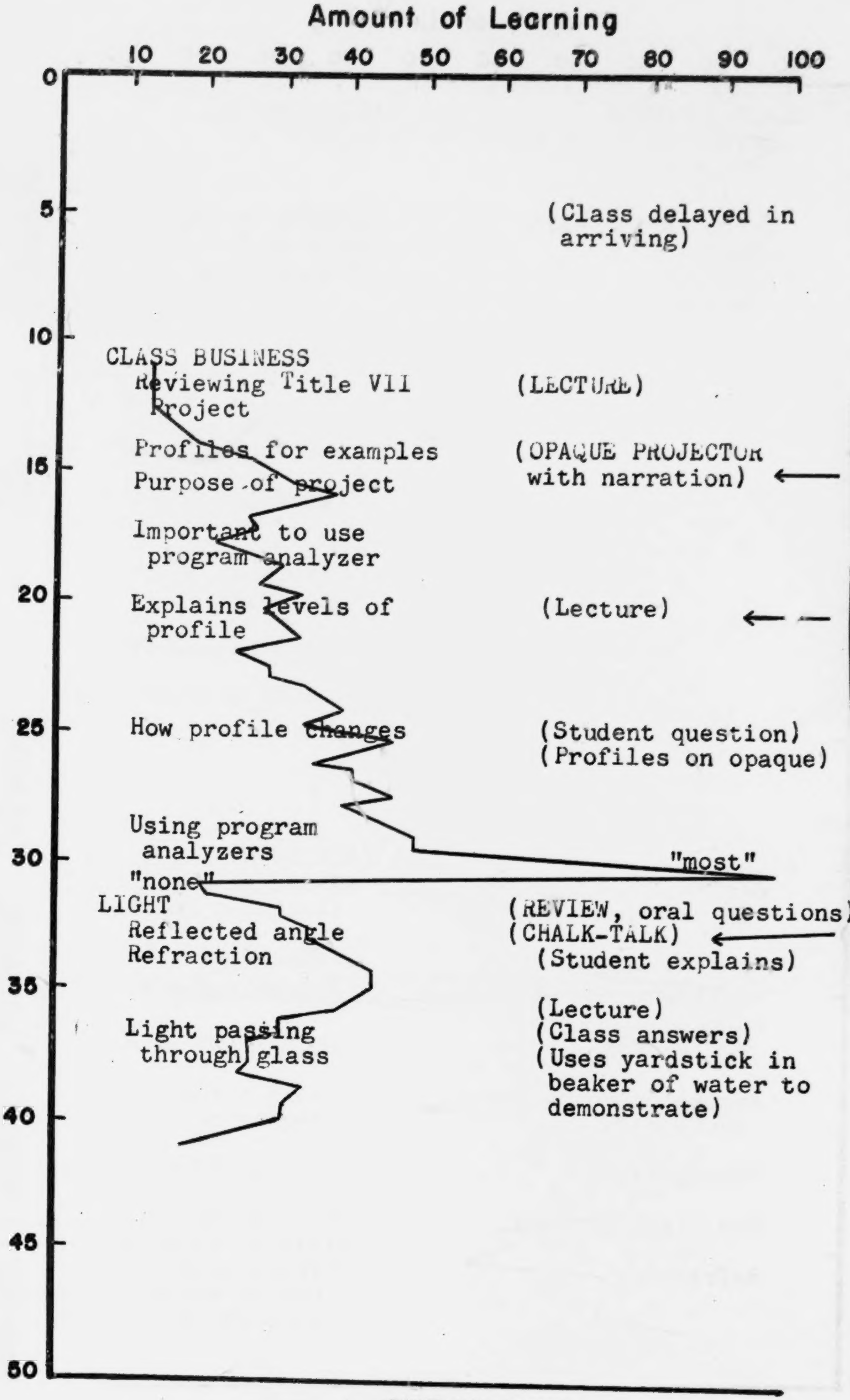
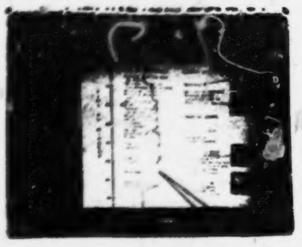
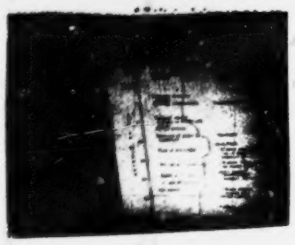
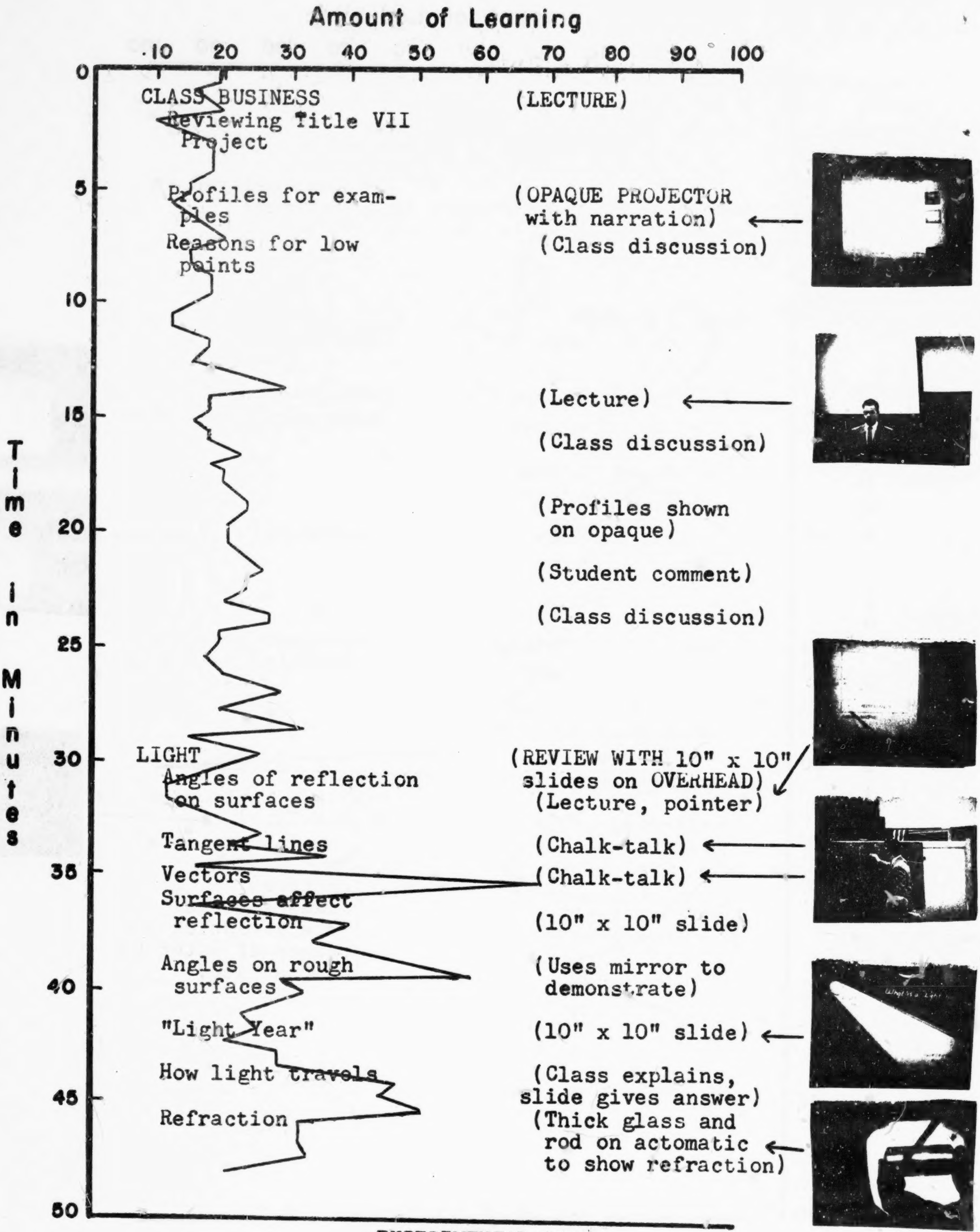
* "Light and How It is Refracted", Society for Visual Education, n.d. Color, 51 frames.







CONTROL GROUP
LEARNING PROFILE NUMBER 233



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 234

ANALYSIS OF LEARNING PROFILES 233 AND 234

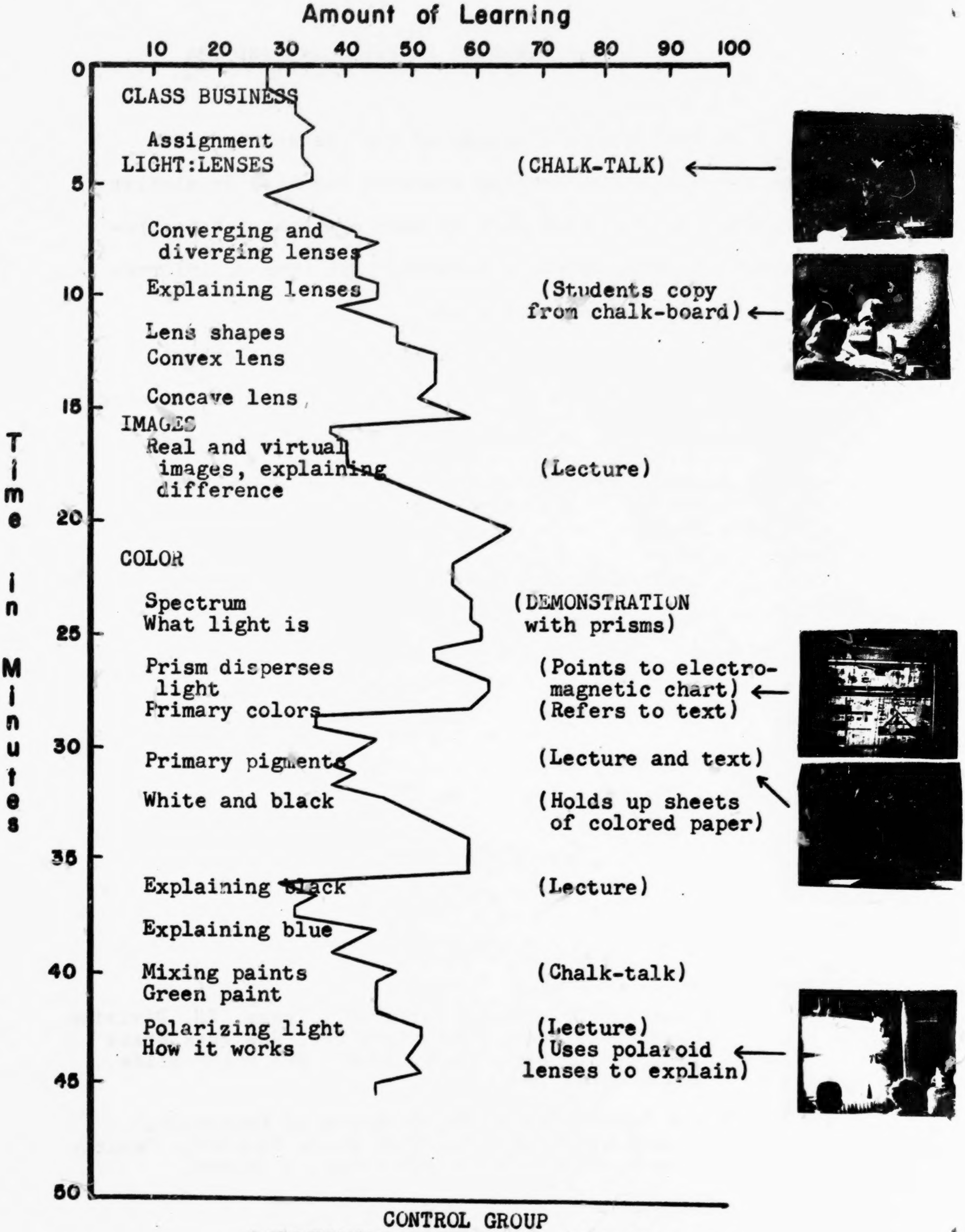
In both groups a review of the research project and the use of the program analyzer resulted in similar profiles in the first part of each class, but interpretation of these profiles covering that type of information is not part of this study.

A review on light by chalk-talk in the Control Group (C 233, 33-41) did not result in peaks of learning which were as high as those in the Experimental Group where overhead transparencies* and objects were used. (E 234, 30-48).

---

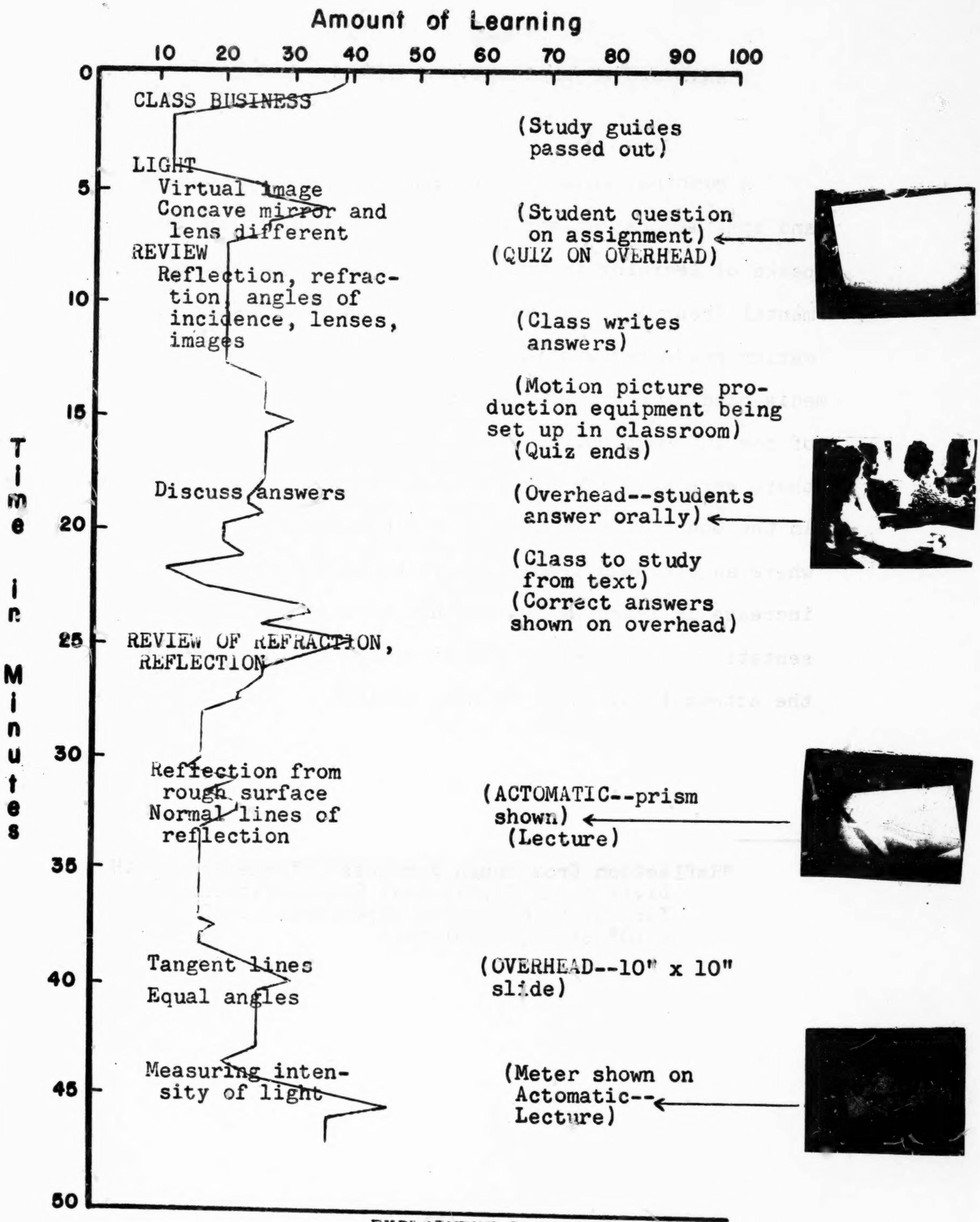
* "Reflection from Rough Surfaces", Trans. XH, Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, 2 colors.

"Light Year", Trans. XA, Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, 2 colors.



CONTROL GROUP

LEARNING PROFILE NUMBER 235



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 236

ANALYSIS OF LEARNING PROFILES 235 AND 236

A combination of chalk-talk lecture with objects and some demonstrations using lenses resulted in several peaks of learning in the Control Group. In the Experimental Group learning was not as high because the information presented was in review form, since content-packed media used in previous classes had already covered much of the information taken up in the Control Group. Also, there were actually more visual type materials presented in the Control Group than in the Experimental Group, where an overhead transparency* brought a considerable increase in learning but was not as high as such a presentation as the use of a meter which was presented on the Actomatic overhead (E 236, 45-46).

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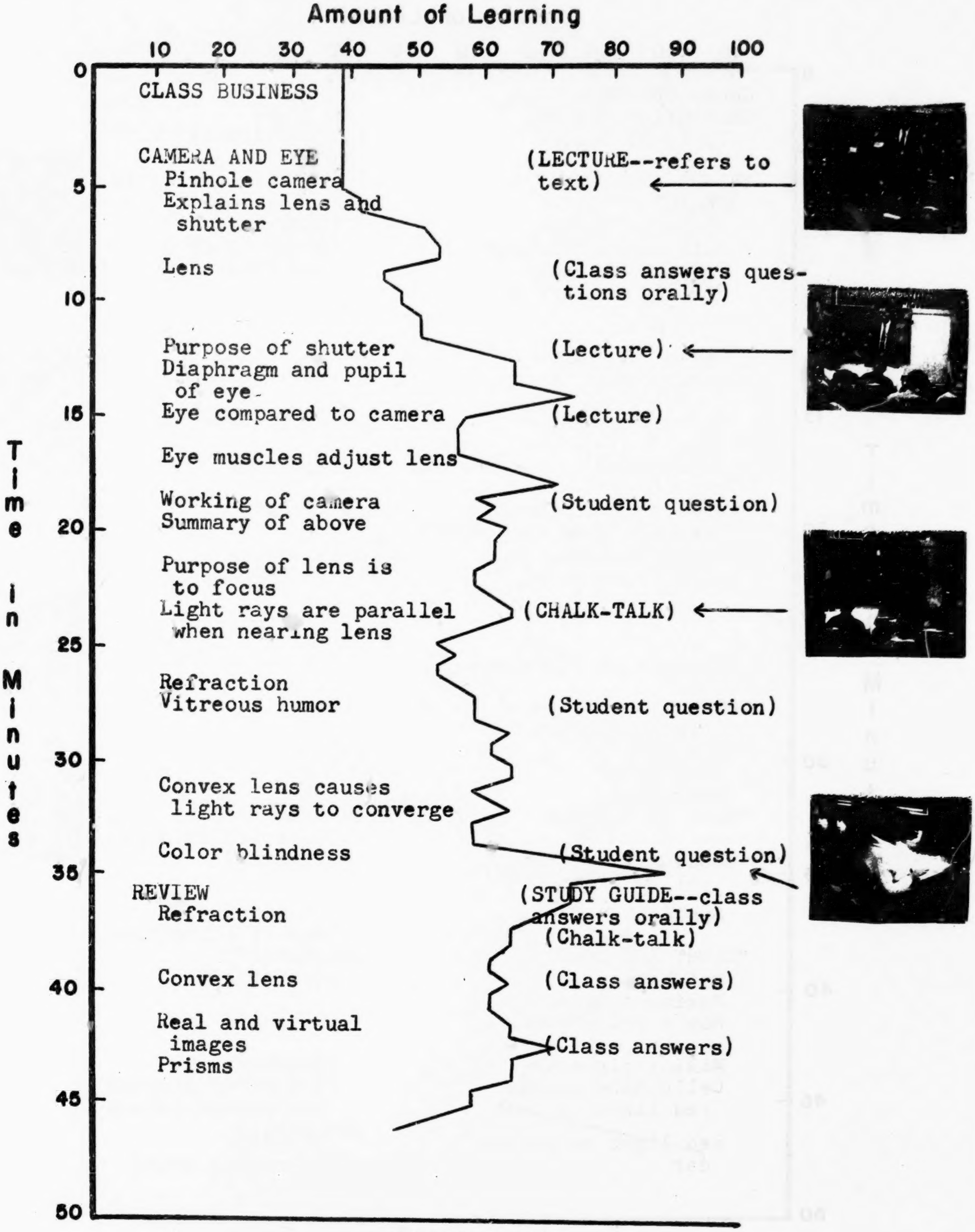
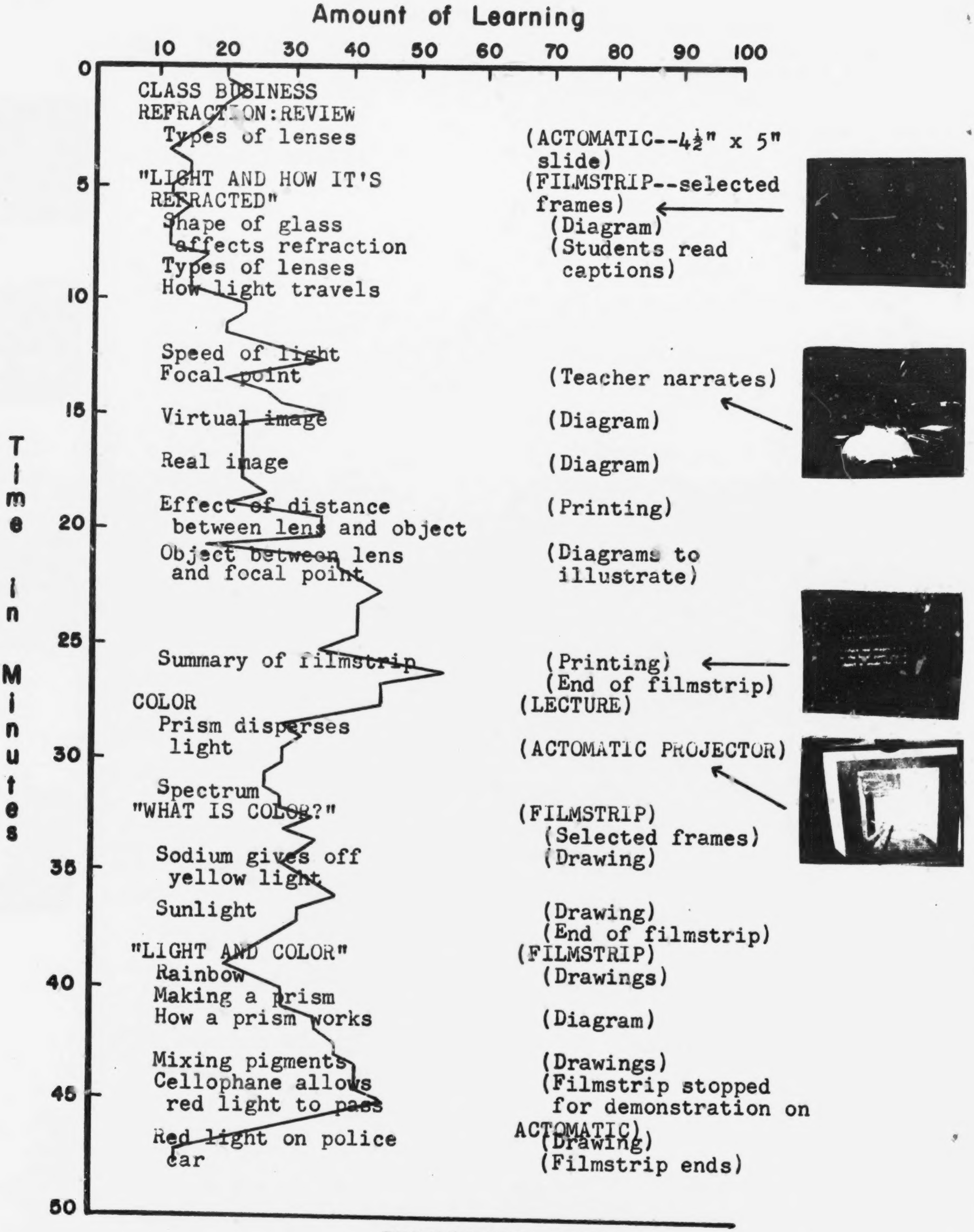
* "Reflection from Rough Surfaces", Transparency XH, Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, 2 colors.



CONTROL GROUP

LEARNING PROFILE NUMBER 237



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 238

ANALYSIS OF LEARNING PROFILES 237 AND 238

A high level of learning resulted in the Control Group when the teacher began the class with a textbook illustration and moved on to explain by lecture and chalk-talk functions of the camera and eye. A rather unusual peak of learning resulted from a student question because it brought up an area which provided new information for the class (C 237, 34). A review caused the profile to become more level.

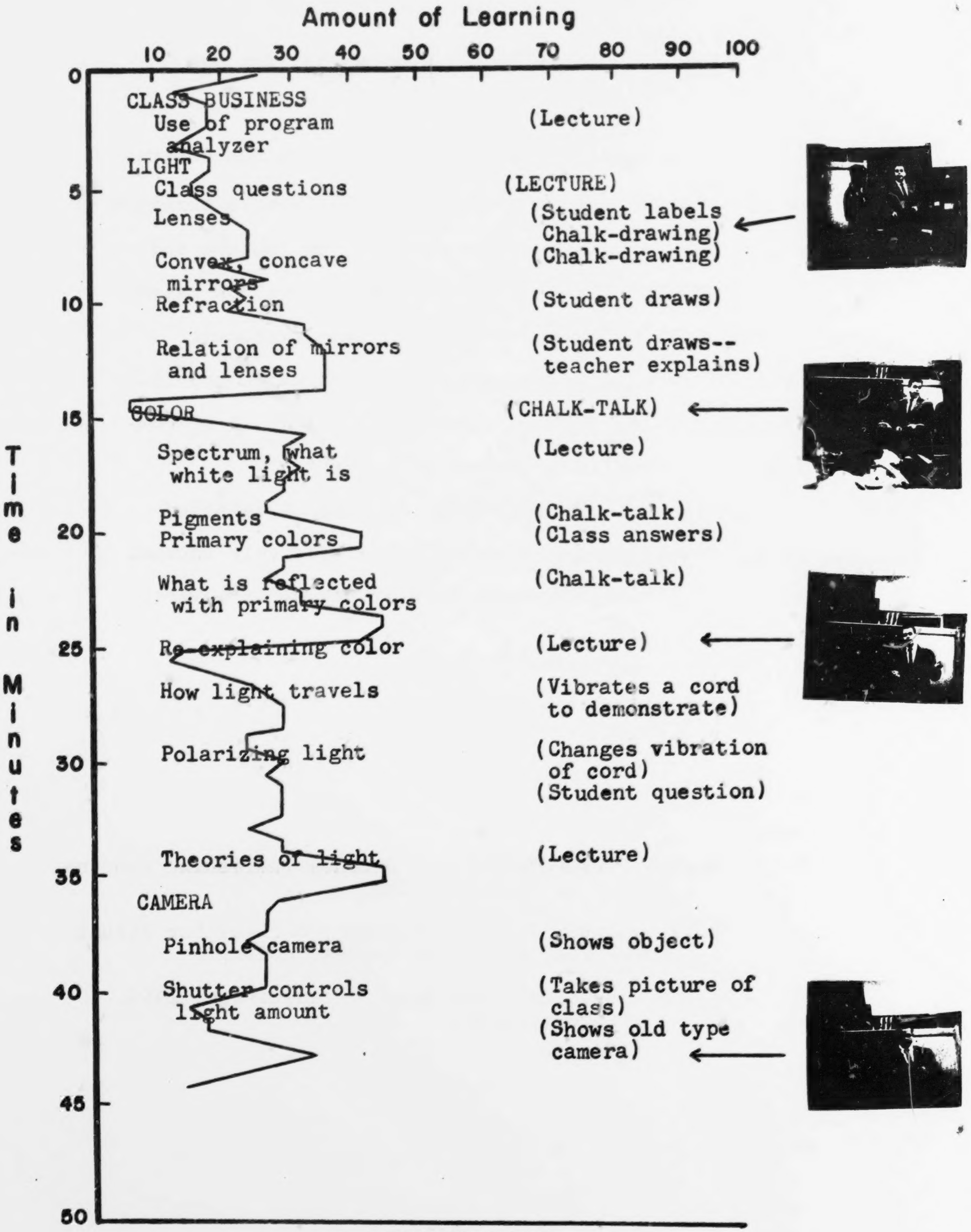
In the Experimental Group the use of selected frames from filmstrips resulted in relatively unusual peaks of learning for such a quick review of several topics.*

---

* "What Is Color?", Popular Science Publishing Company, 1953. 50 frames, color.

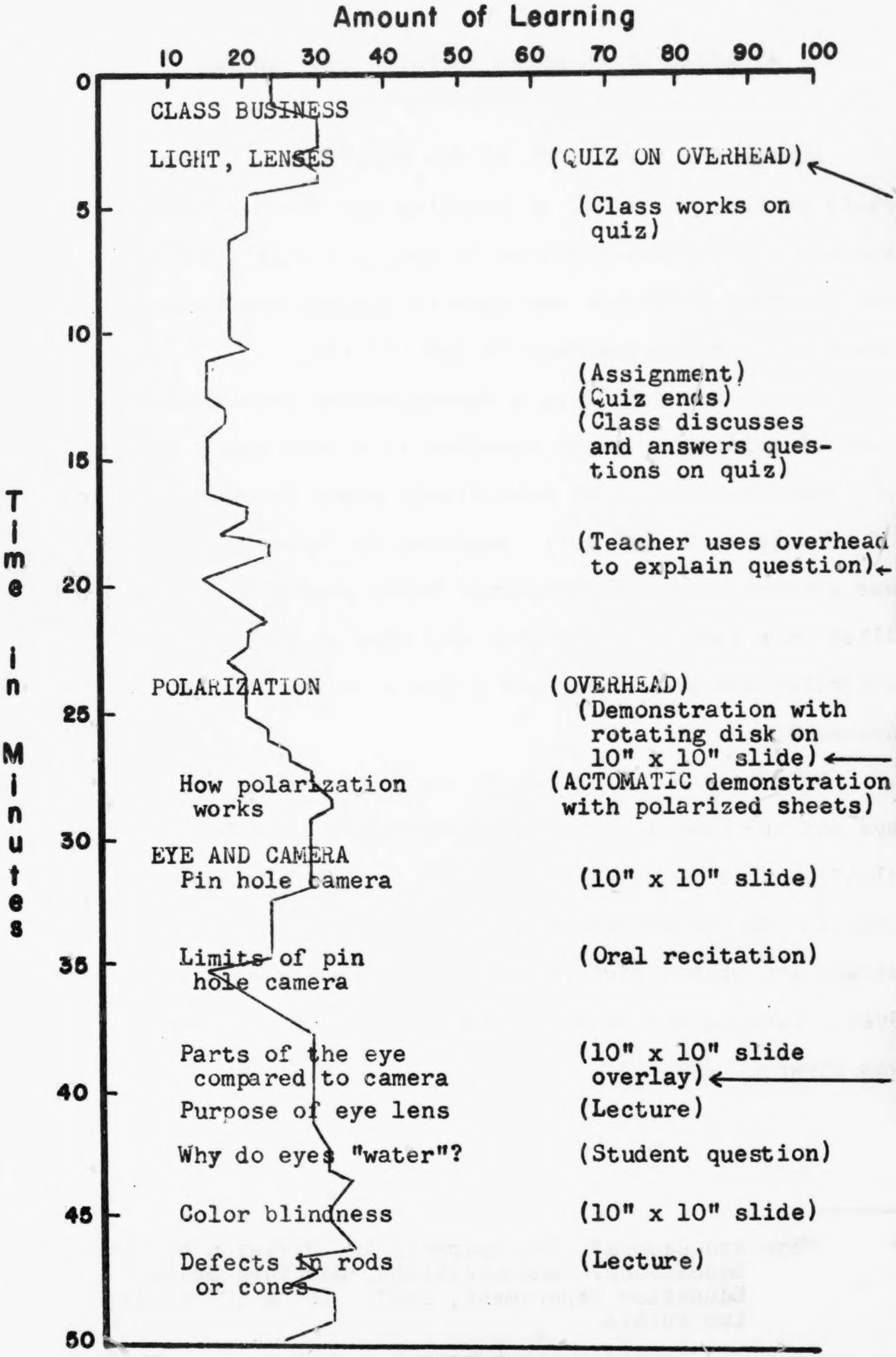
"Light and How It is Refracted", Society for Visual Education, n.d.. 45 frames, color.

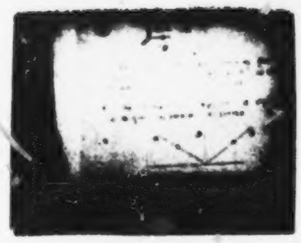
"Light and Color", Jam Handy Organization, 1959. frames, color.

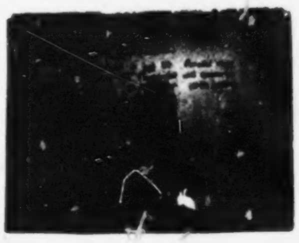


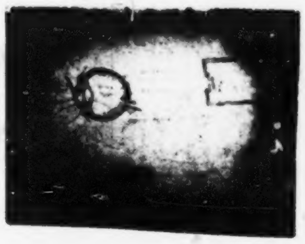
CONTROL GROUP

LEARNING PROFILE NUMBER 239









EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 240

ANALYSIS OF LEARNING PROFILES 239 AND 240

During the first part of the Experimental Group class period, the level of learning was fairly constant since the group was involved in taking a quiz. Since the overhead projector was used to explain the answers, peaks of learning resulted (E 240, 17-18).

In the Control Group a demonstration and explanation of polarizing light resulted in a very small learning peak in relation to much higher peaks in other portions of the class (C 239, 30). Learning the same information was greater in the Experimental Group when a polarized filter on a revolving analyzer was used on the overhead projector and when polarized filters were placed on the Actomatic.

An overhead transparency* was used to compare the eye and the camera in the Experimental Group (E 240, 31-47). This resulted in a higher profile of learning than in the Control Group where a pinhole camera was shown, and when a picture was taken of the class; however, learning did increase when an old type of camera was shown (C 239, 43).

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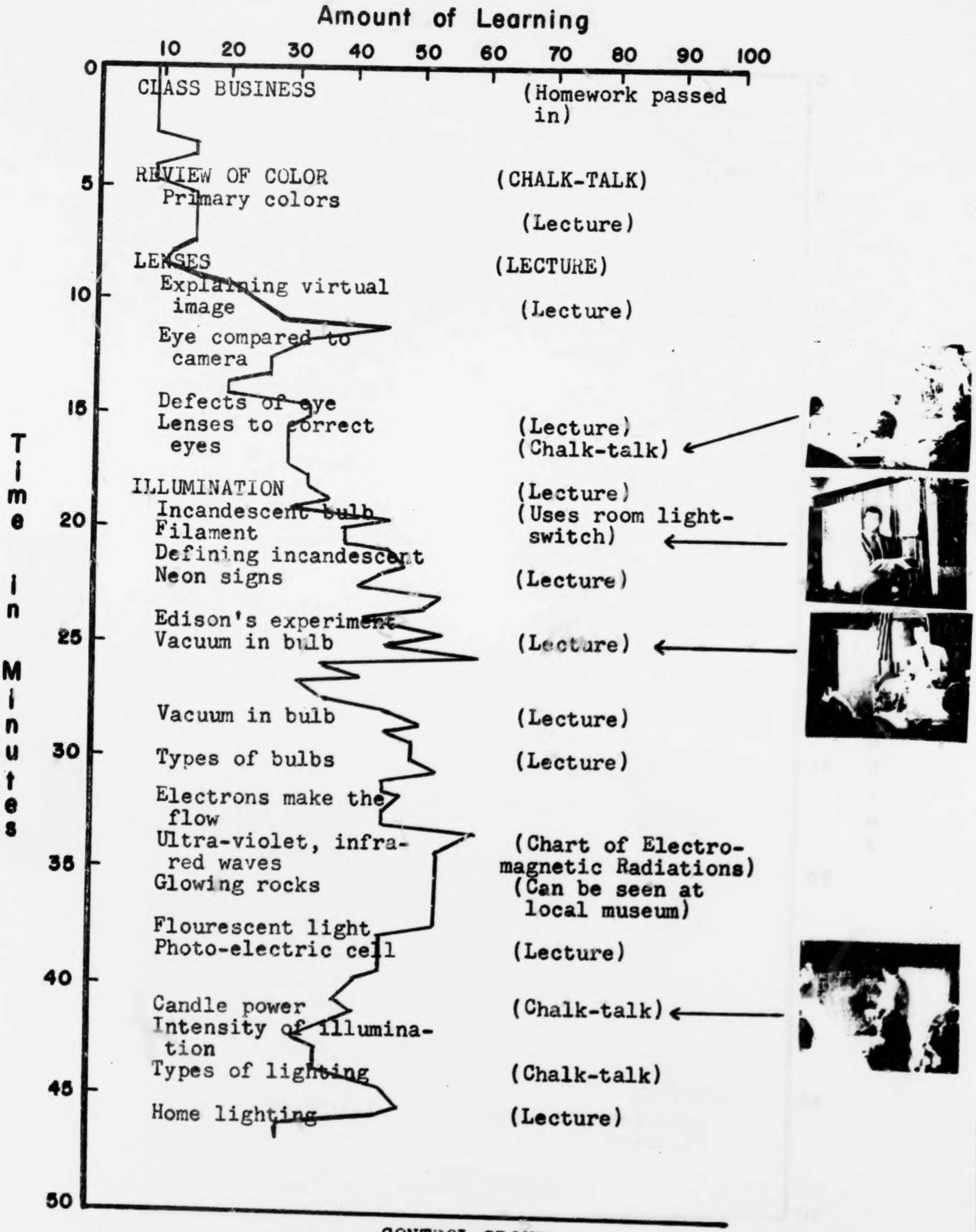
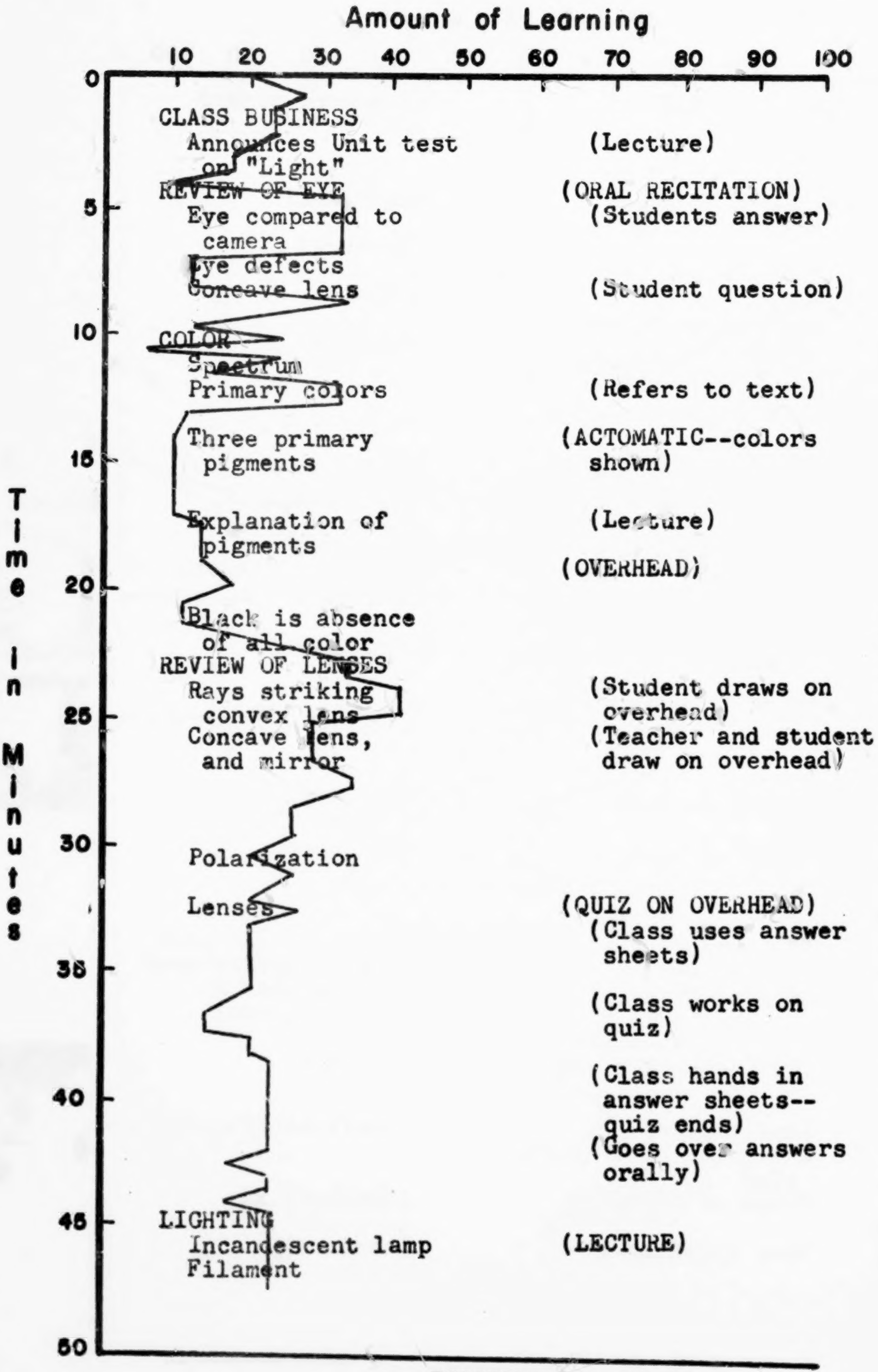
* "Eye and Camera", Transparency XO, Division of Educational Communications, New York State Education Department, 1960. 10" x 10" slide, two colors.



CONTROL GROUP

LEARNING PROFILE NUMBER 241



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 242

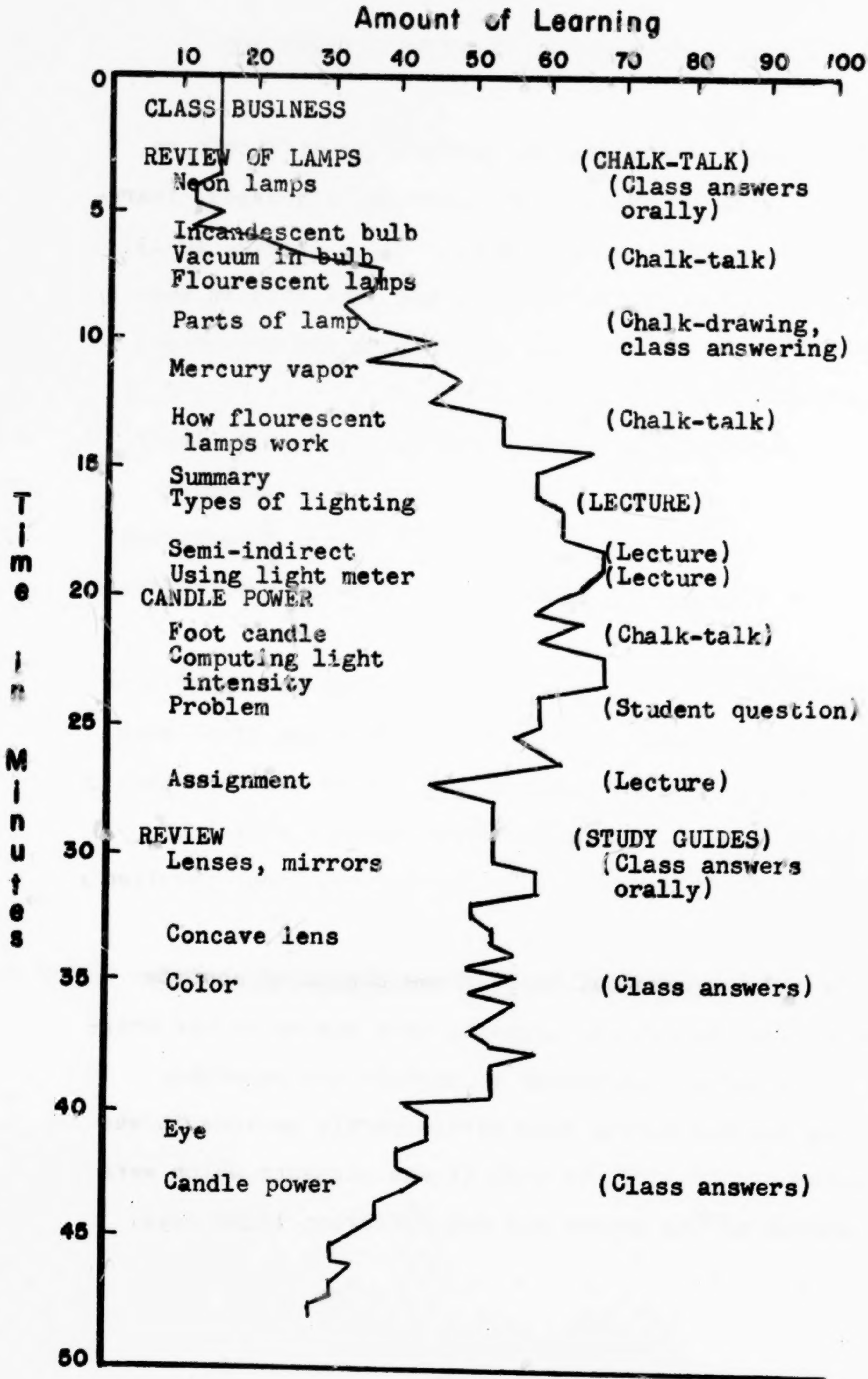
ANALYSIS OF LEARNING PROFILES 241 AND 242

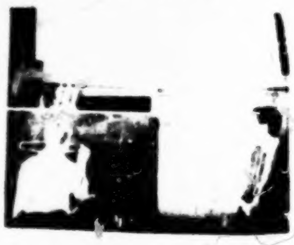
The content of these two profiles is difficult to compare. In the portion where color was discussed, learning was greater in the Experimental Group (E 242, 10-13) where a reference to the textbook was made than in the Control Group where the same information was presented by chalk-talk and lecture (C 241, 4-8).

The Experimental Group profile was generally lower because there was more of the review type of material in it. A peak of learning did result in the Experimental Group when a student participated by drawing with a grease pencil on the overhead (E 242, 24).

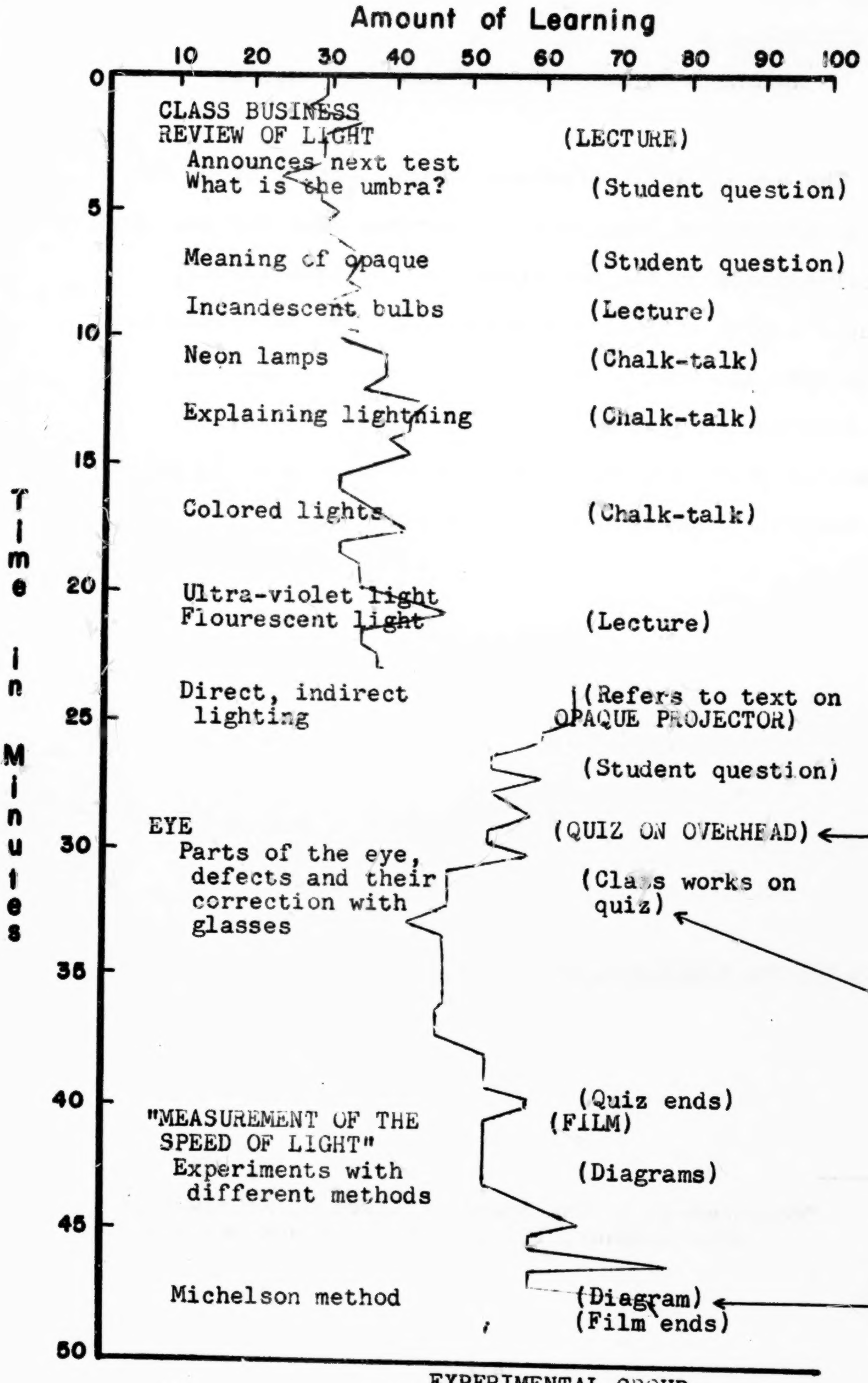
Lecture in the Control Group resulted in significant peaks of learning (C 241, 19-46) but this was given much more time than the three-minute lecture on the same subject at the end of the Experimental class. A peak of learning during the lecture in the Control Group resulted from reference to a chart (C 241, 34).

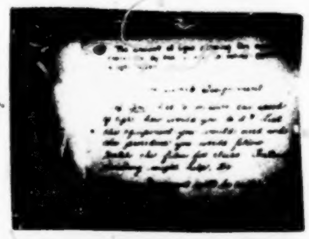
In the Experimental Group three pieces of acetate representing the primary pigments were placed on the overhead projector and projected to explain the pigments. Learning was low during this period partly because it was not clear to the students that it was pigments which were represented on the screen and not different light rays.





CONTROL GROUP
LEARNING PROFILE NUMBER 243





EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 244

ANALYSIS OF LEARNING PROFILES 243 AND 244

The use of chalk drawings in the Control Group resulted in greater increases in learning than the use of verbal symbols on the chalkboard in the Experimental Group. A peak of learning resulted in the Experimental Group when the opaque projector was used (E 244, 24). The Experimental Group learned at a high level, information above and beyond that which was taken up in the Control Group with a film presentation.*

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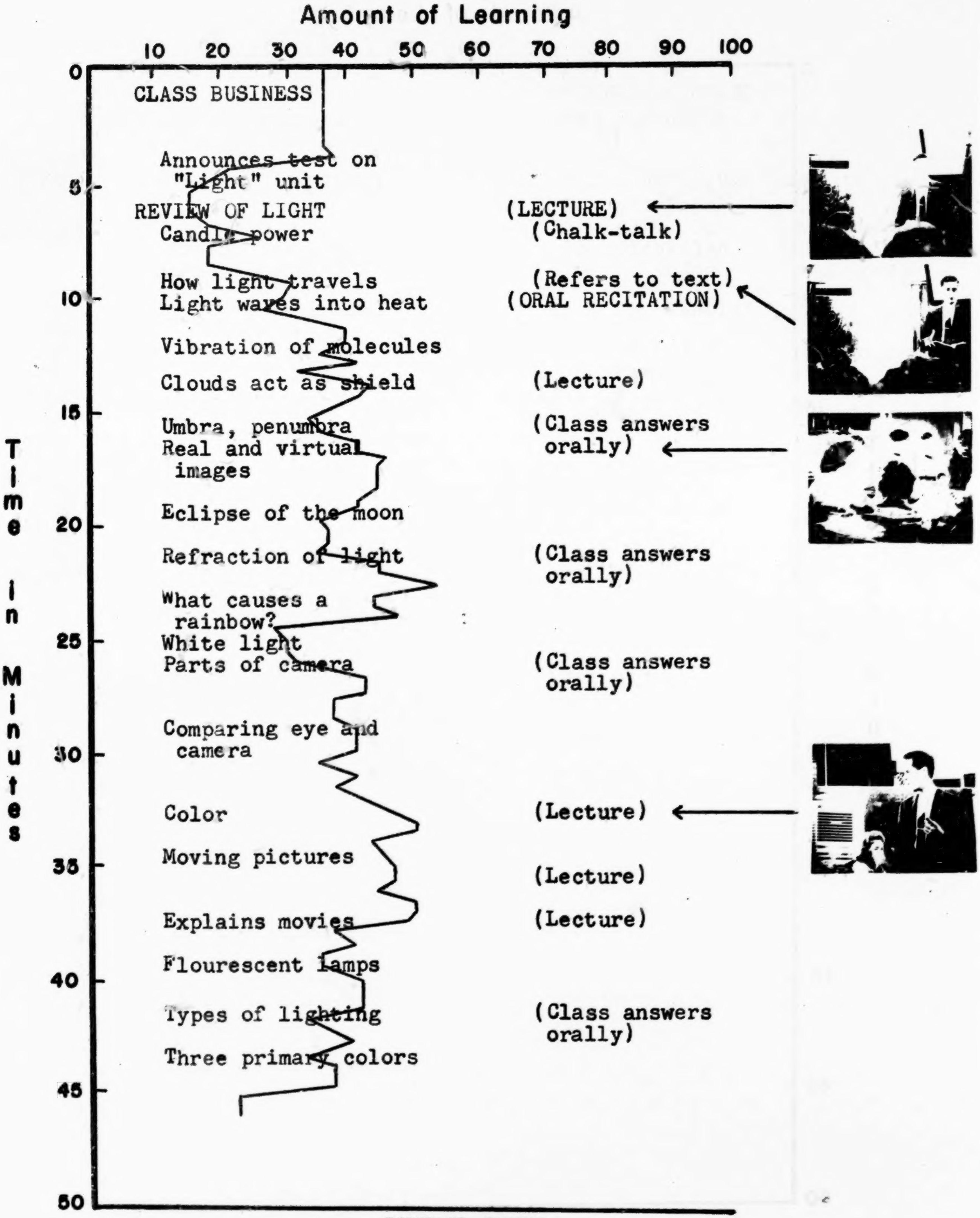
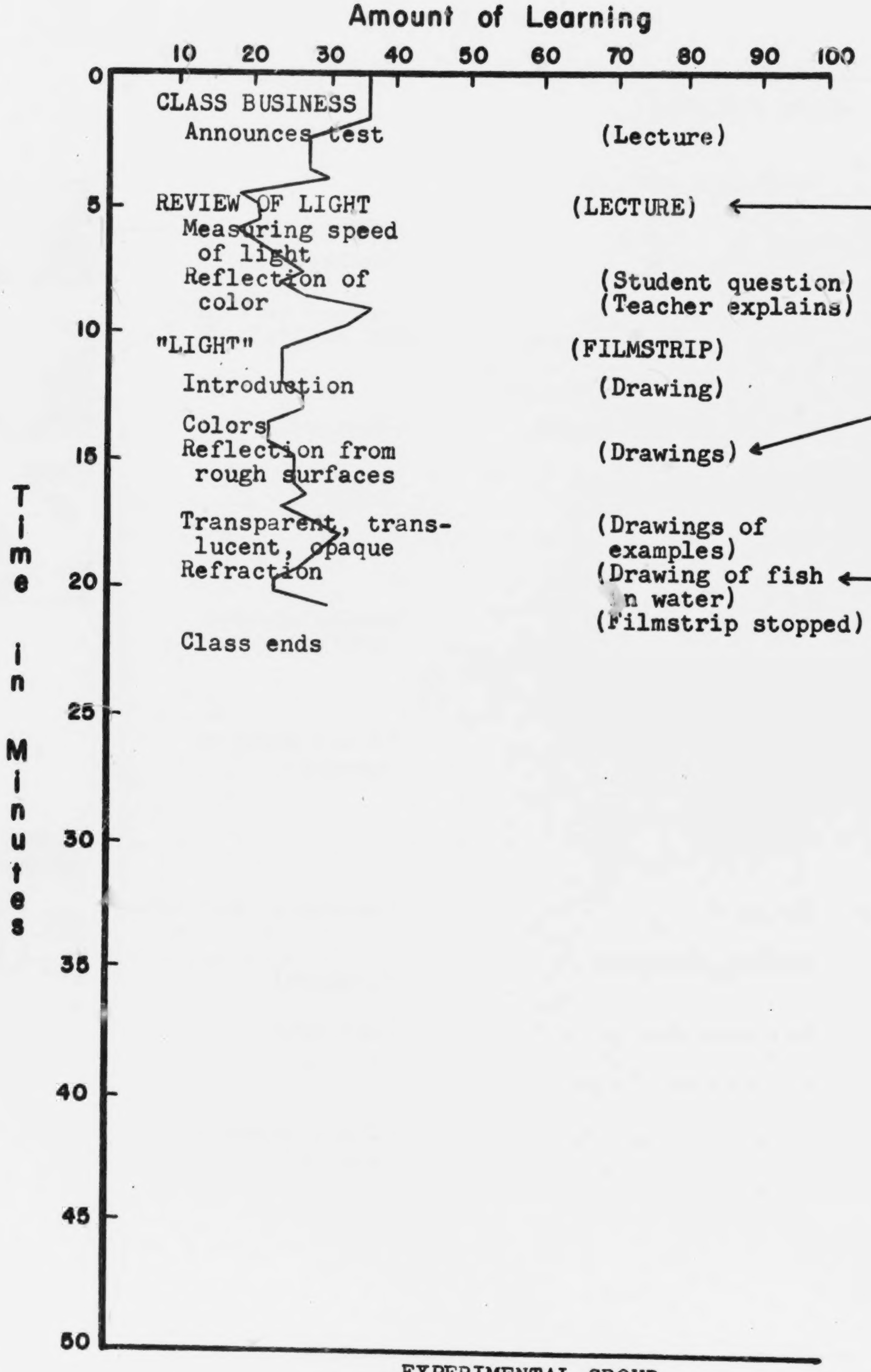
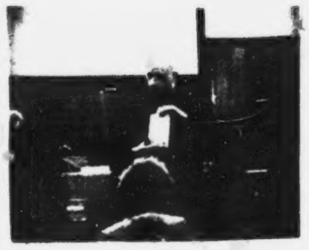
* "Measurement of the Speed of Light ", McGraw-Hill Book Company, 1952. 9 min., black and white.



CONTROL GROUP

LEARNING PROFILE NUMBER 245





EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 246

ANALYSIS OF LEARNING PROFILES 245 AND 246

The school schedule caused the Experimental Group to receive a very short class period. Learning showed no high peaks during the beginning portion of a filmstrip.* The highest point was where examples were shown in drawings (E 246, 18). A high point (C 245, 22-23) in the Control Group concerned a topic which had been taken up several times previously, indicating that a question and answer in the class finally clarified this topic to the students. Other high points of learning were during an explanation of motion pictures which was new information to the students (C 245, 34-38).

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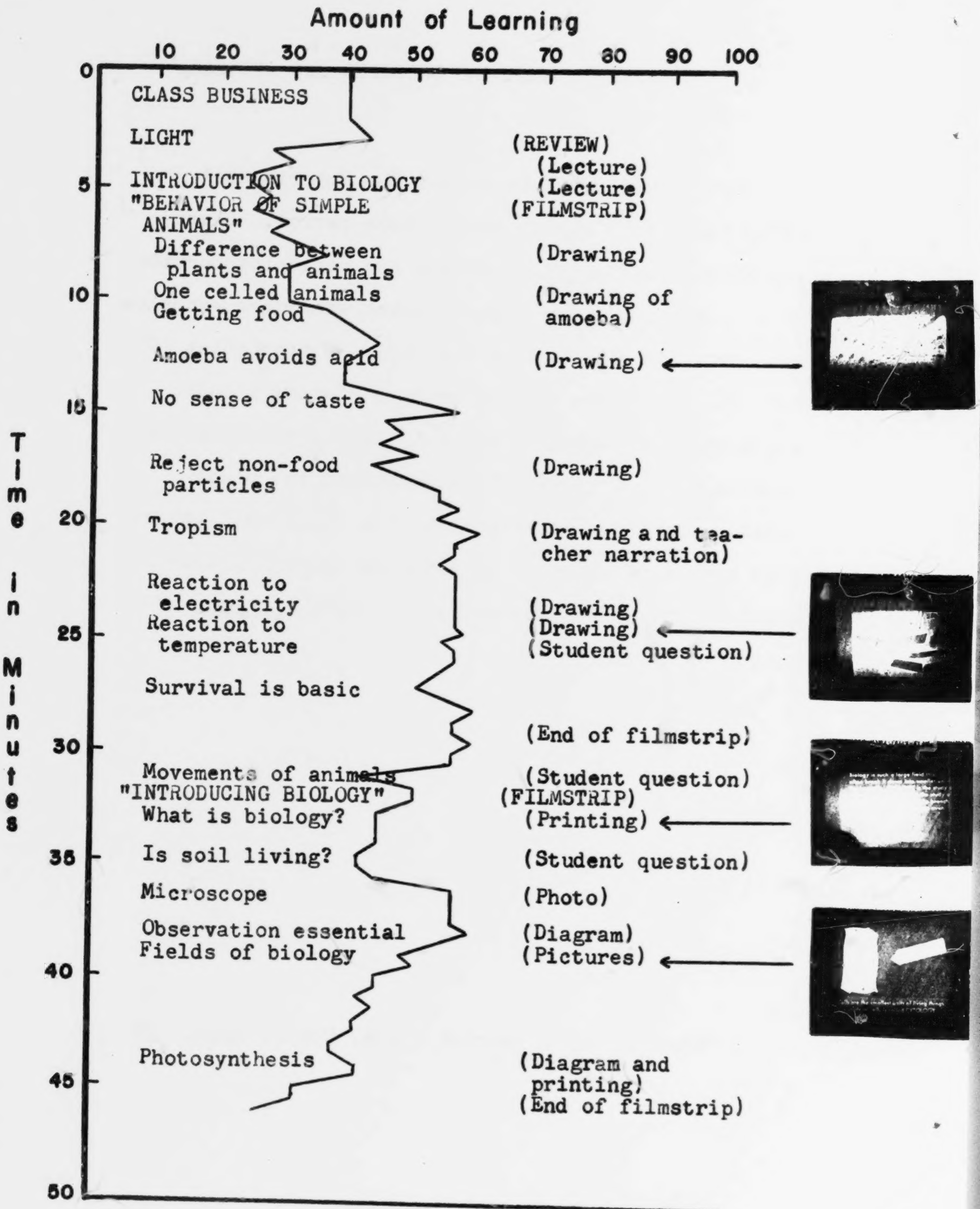
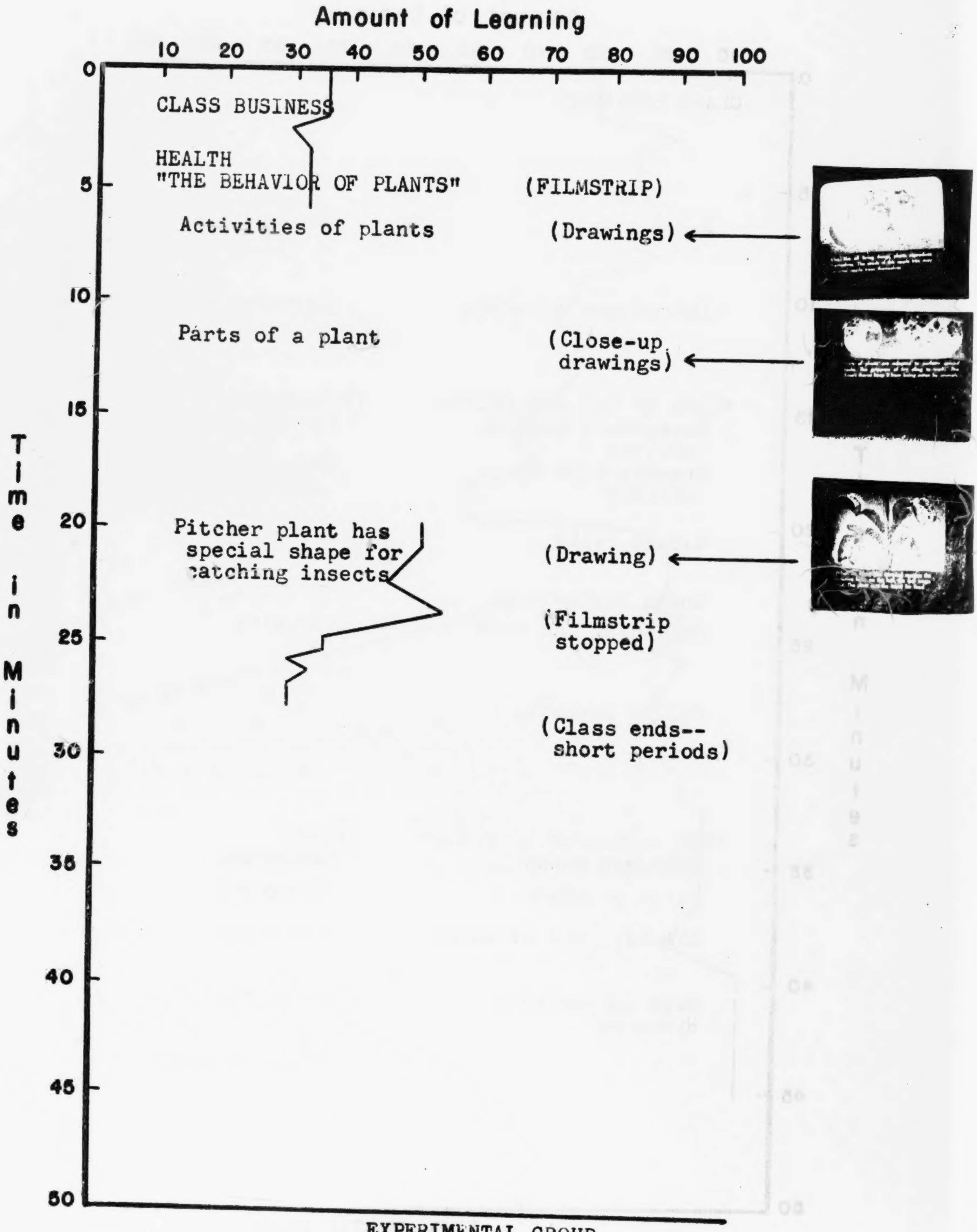
* "Light", Young America Films, Corp., 1952. 37 frames, color.



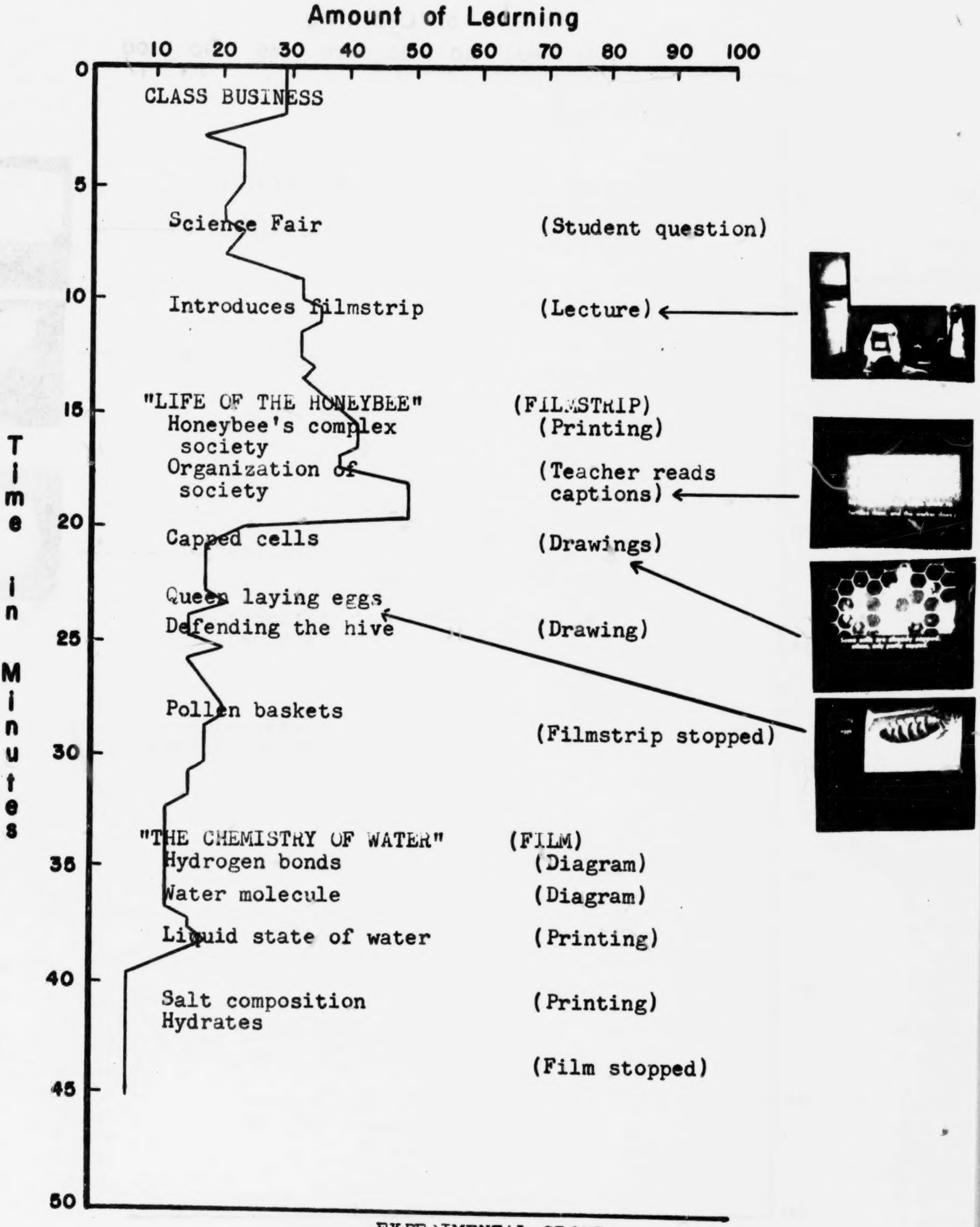
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER AA



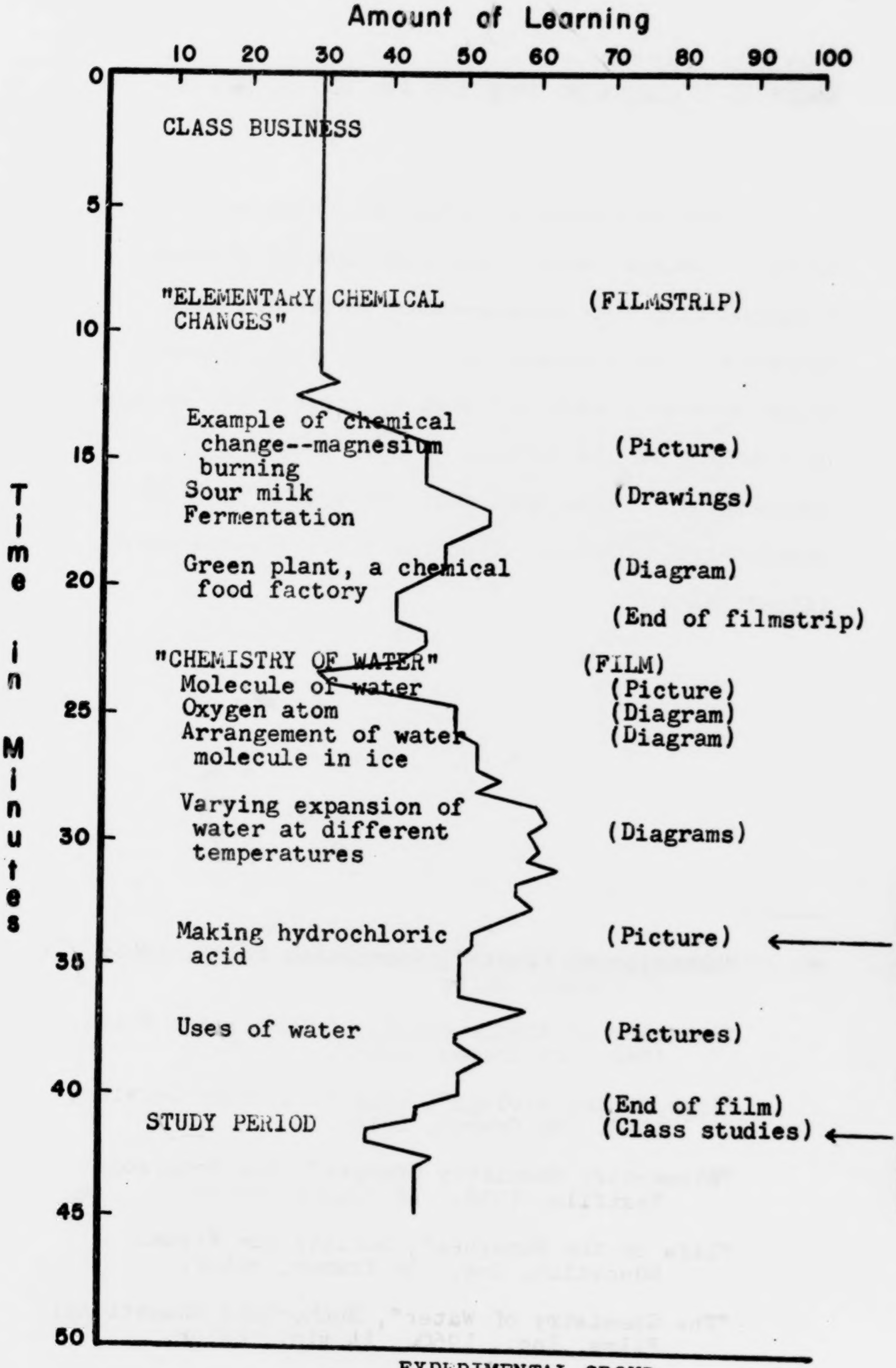
EXPERIMENTAL GROUP

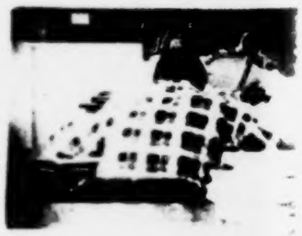
LEARNING PROFILE NUMBER BB



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER CC





EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER DD

ANALYSIS OF LEARNING PROFILES AA, BB, CC AND DD

It was necessary to delay one group in order to switch control and experimental classes. Consequently, some supplementary materials were presented. No analysis is provided here, since these materials were not used to replace low degrees of learning in the Control Group. However, it is interesting to note that these materials yielded fairly high profiles. Specific materials used are listed below.*

---

* "Behavior of Plants", Curriculum Films, 1960. 27 frames, color.

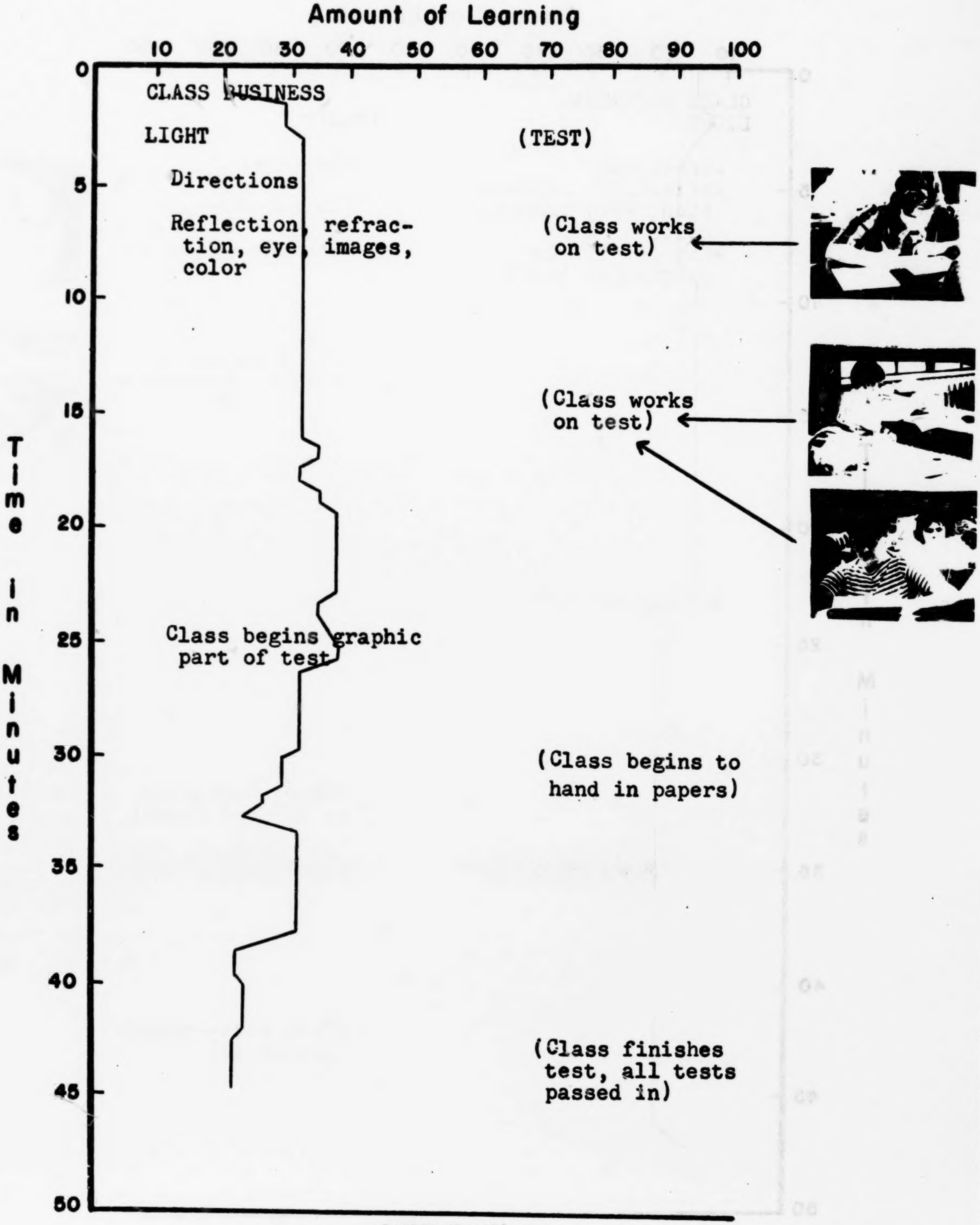
"Behavior of Simple Animals," Curriculum Films, 1960. 27 frames, color.

"Introducing Biology", Long Film Slide Service, 1956. 26 frames, color.

"Elementary Chemistry Changes", Row Peterson Textfilm, 1958. 46 frames, color.

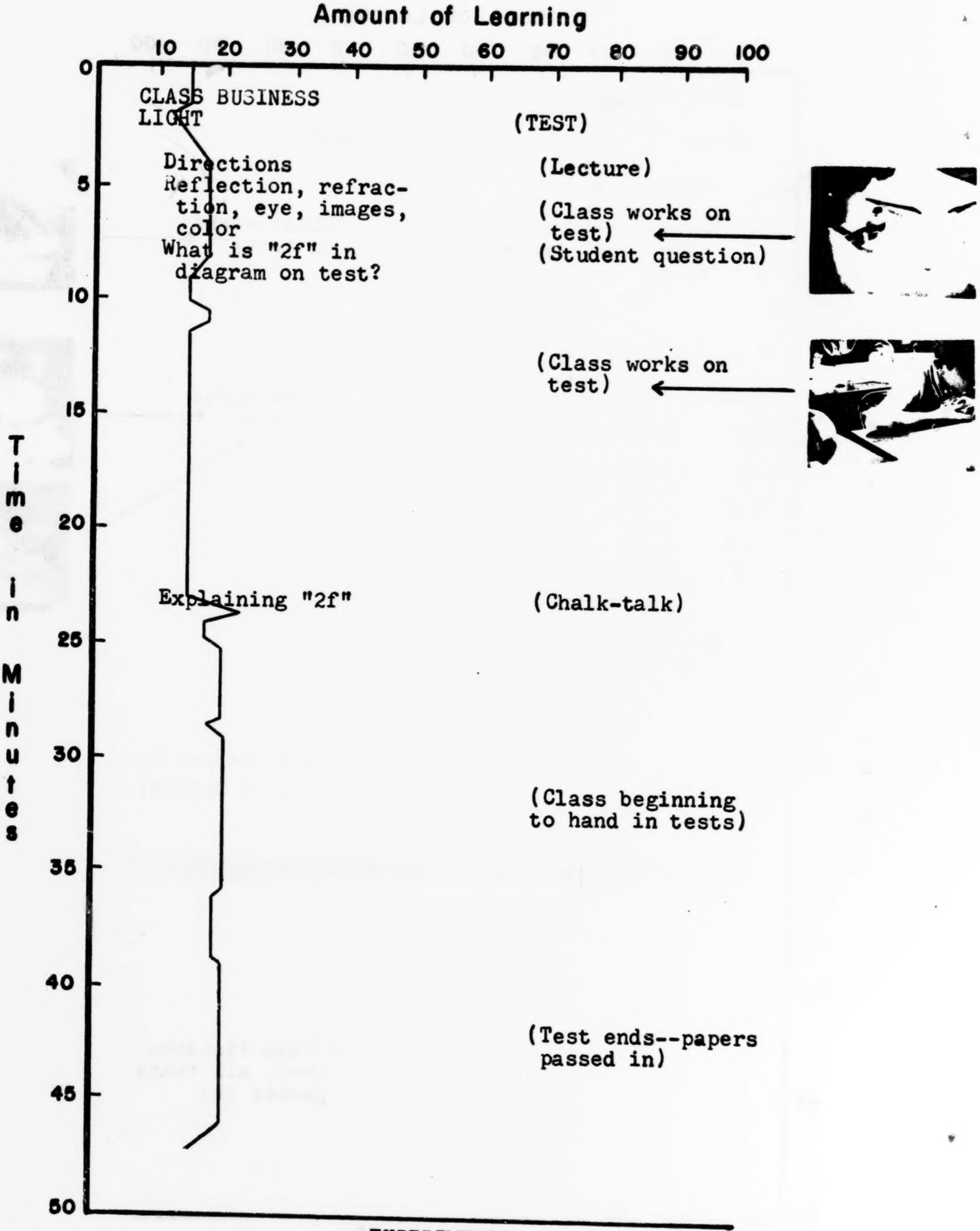
"Life of the Honeybee", Society for Visual Education, Inc., 39 frames, color.

"The Chemistry of Water", Sutherland Educational Films, Inc., 1960. 14 min., color.



CONTROL GROUP

LEARNING PROFILE NUMBER 247

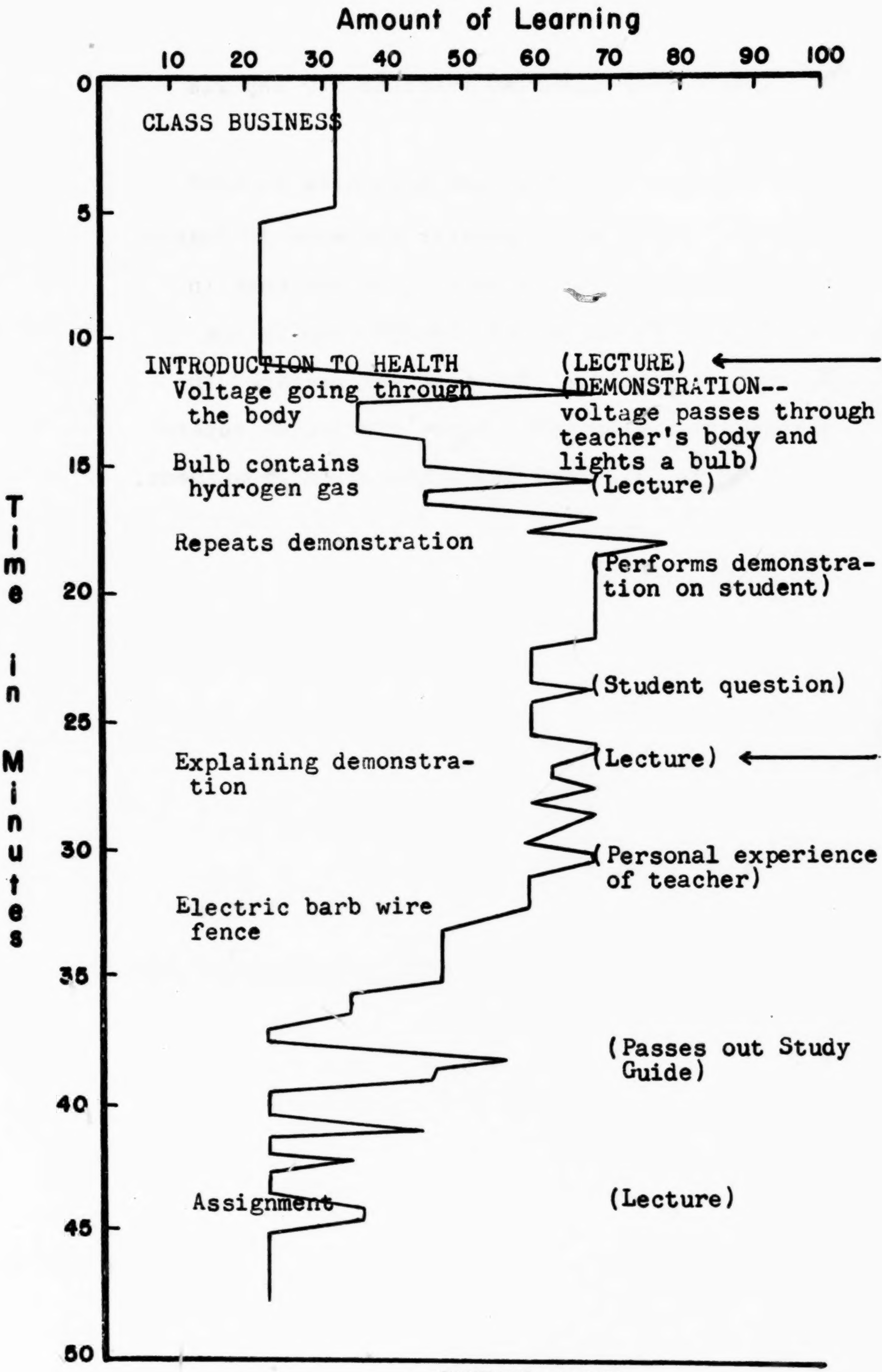


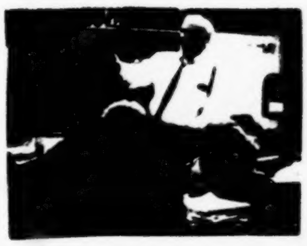
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 248

ANALYSIS OF LEARNING PROFILES 247 AND 248

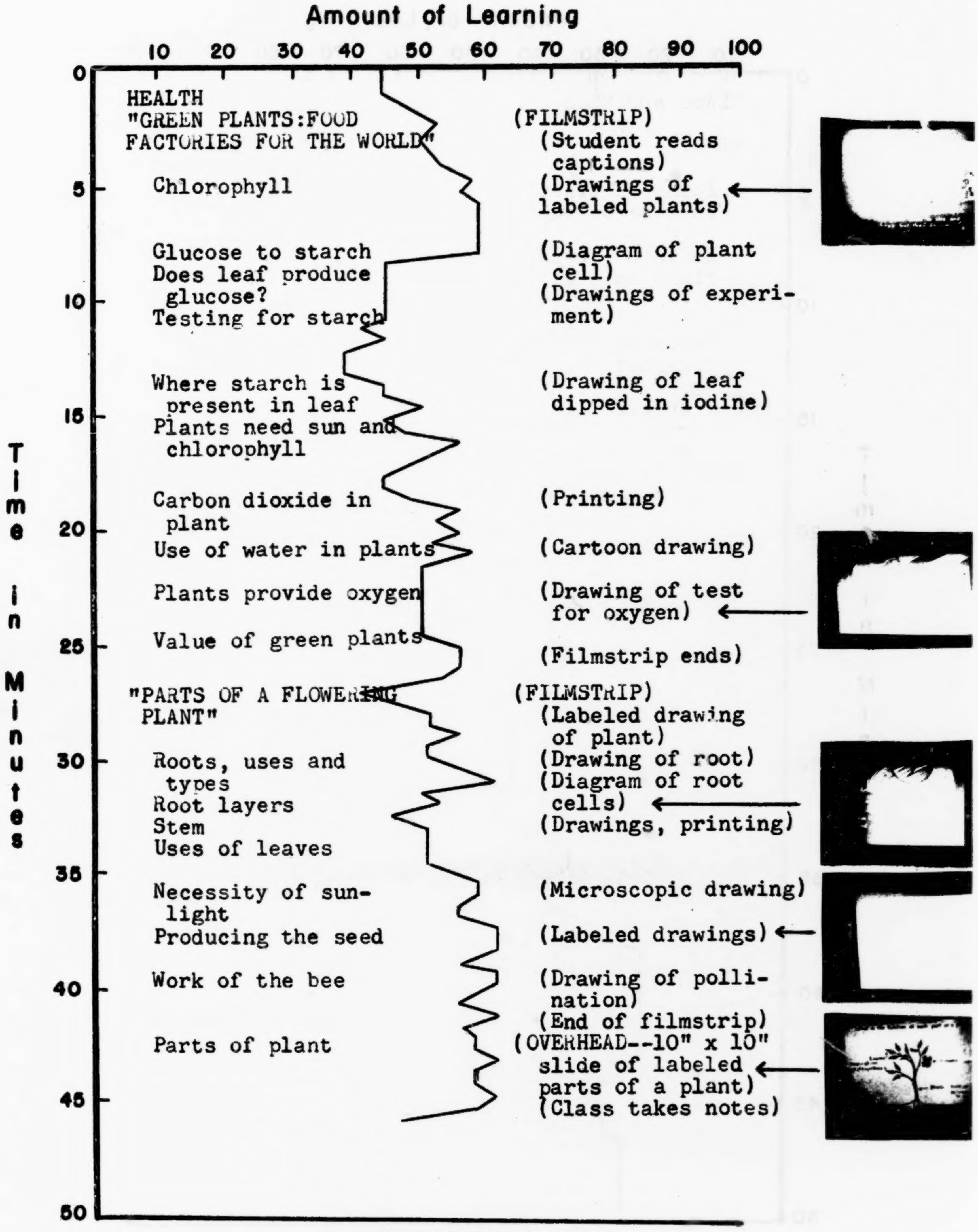
The same unit test was presented to both classes. There was a greater increase in learning during the graphic portion of the test in the Control Group (C 247, 18-27) than in the Experimental Group. The test was prepared in consultation with the science curriculum supervisor of the New York State Education Department.





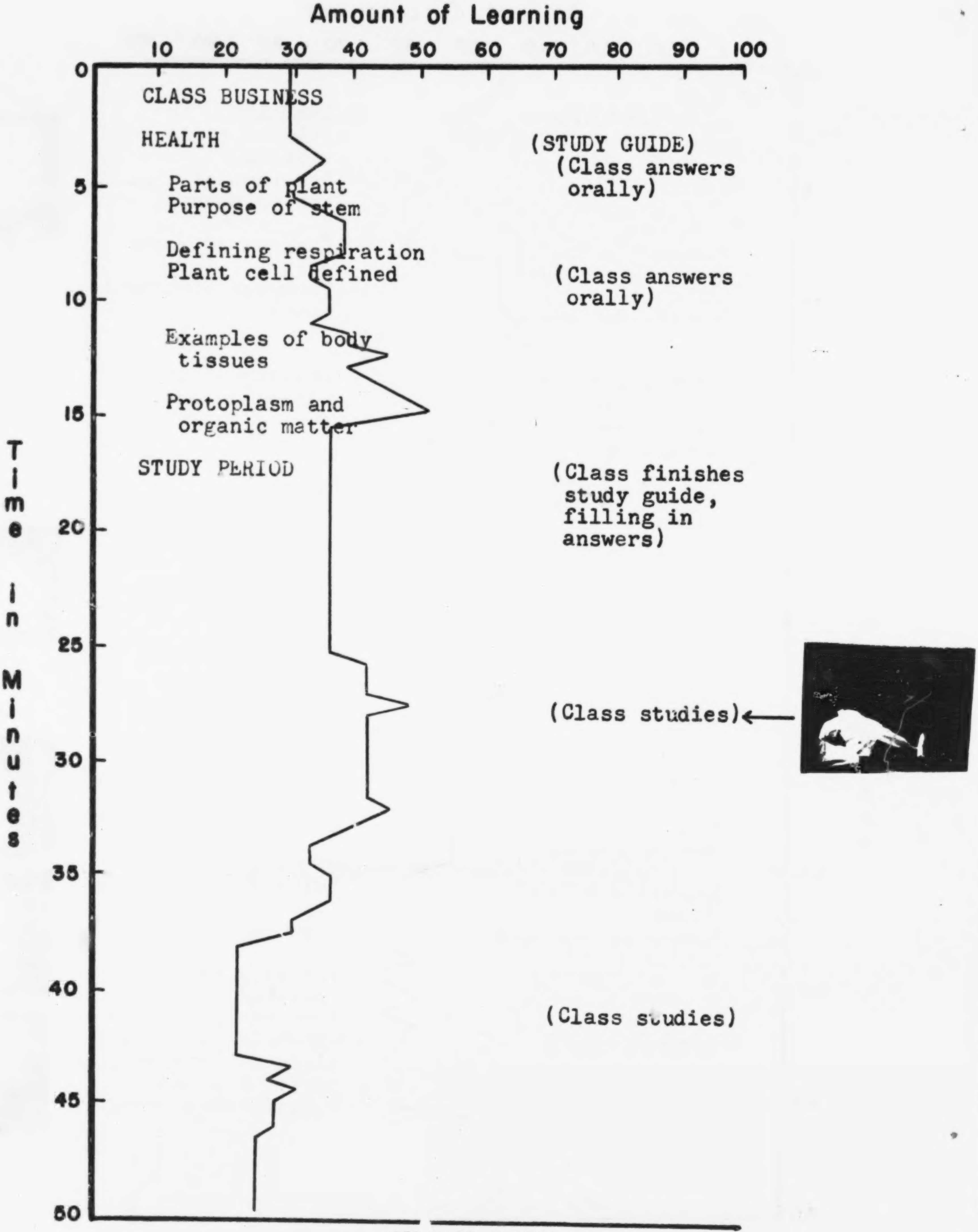
CONTROL GROUP

LEARNING PROFILE NUMBER 249



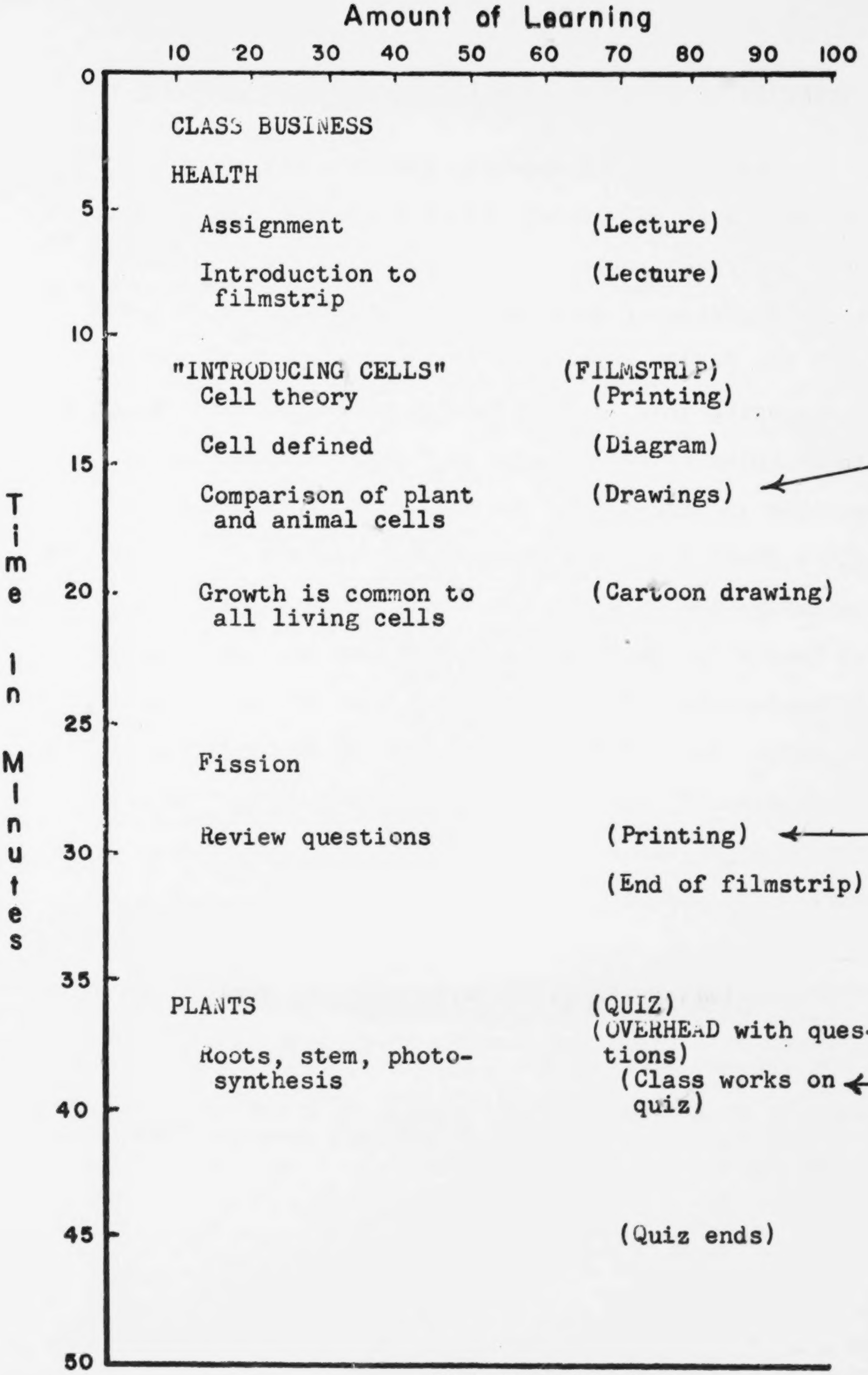
EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 250



CONTROL GROUP

LEARNING PROFILE NUMBER 251



Amount of Learning
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35
40
45
50
Time in Minutes

CLASS BUSINESS	
HEALTH	
Assignment	(Lecture)
Introduction to filmstrip	(Lecture)
"INTRODUCING CELLS"	(FILMSTRIP)
Cell theory	(Printing)
Cell defined	(Diagram)
Comparison of plant and animal cells	(Drawings)
Growth is common to all living cells	(Cartoon drawing)
Fission	
Review questions	(Printing)
	(End of filmstrip)
PLANTS	(QUIZ)
	(OVERHEAD with questions)
Roots, stem, photosynthesis	(Class works on quiz)
	(Quiz ends)

EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 252

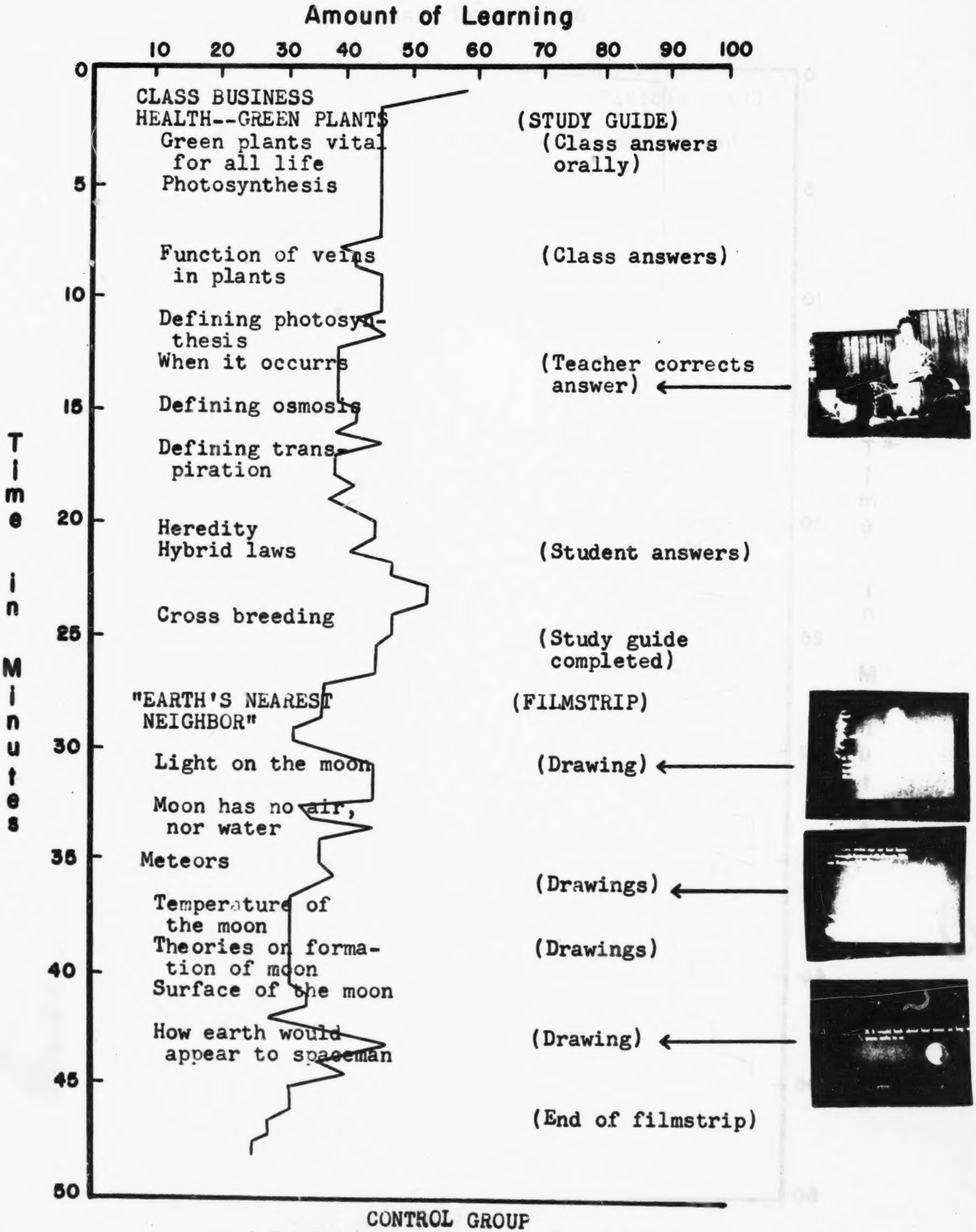
ANALYSIS OF LEARNING PROFILES 249 250 251 and 252

These profiles appeared during a period of adjustment when the control and experimental classes were being switched. Learning Profile Number 250 was still a presentation of supplementary materials before going into the formal pattern of improving learning. It is interesting that on this profile there was some variation in learning in two filmstrips * which were presented rapidly in succession. In the Control Group Number 249 a great variation in learning resulted from a lecture demonstration in which the teacher related the study of health to the study of electricity and provided information which the students had been exposed to previously. In profiles 251 and 252 the new unit was introduced.** No comparisons could be made between the profiles since the program analyzer was broken during the Experimental Group.

---

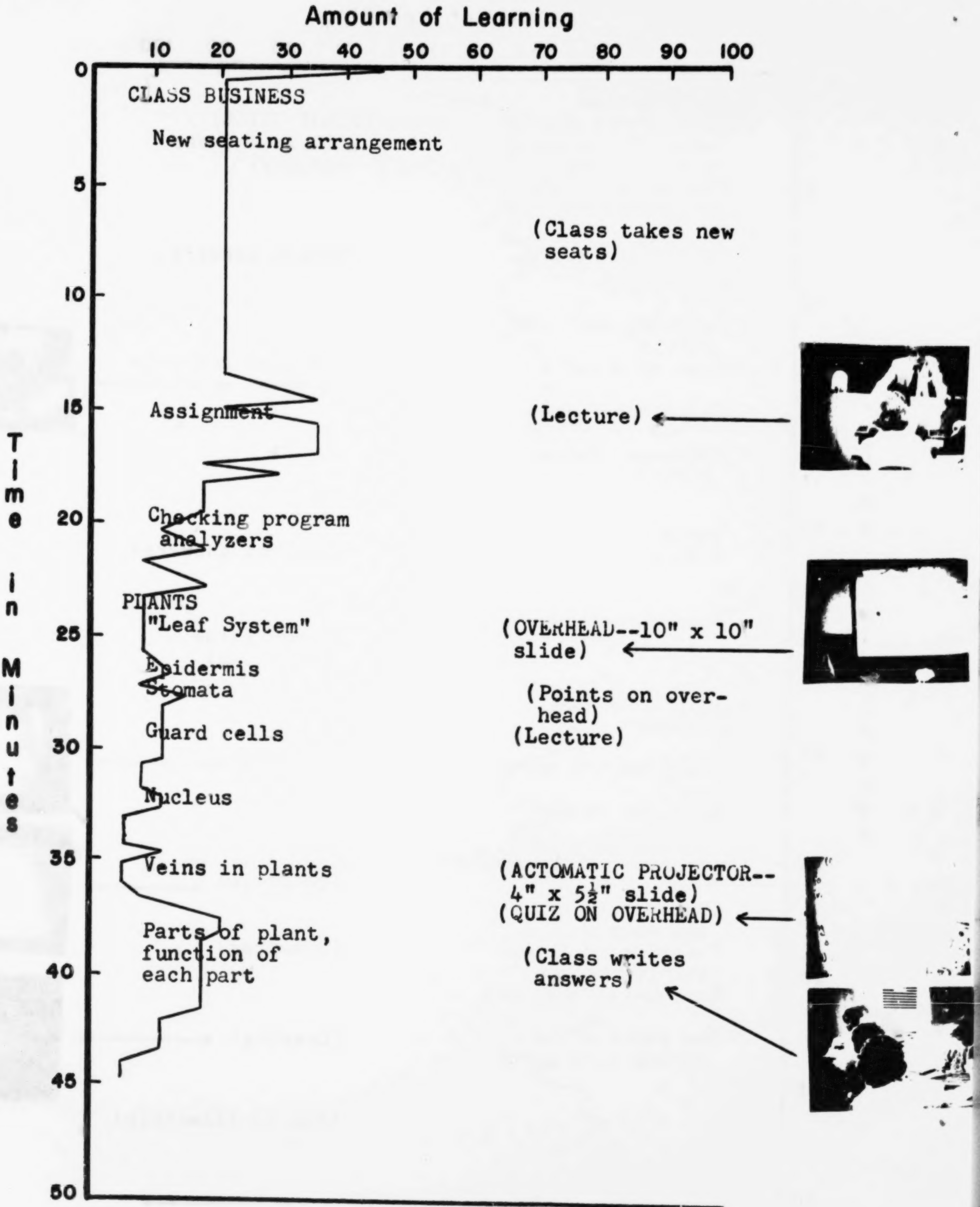
*"Green Plants"--"Food Factories for the World" Harcourt Brace Co., 1957. 38 frames, color
"Parts of a Flowering Plant", Curriculum Films, 1959 25 frames, color.

**"Cell of a Green Plant", TransXl G. 2 colors
"Introducing Cells", Long Filmslide Service, 1961. 28 frames, color.



CONTROL GROUP

LEARNING PROFILE NUMBER 253



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 254

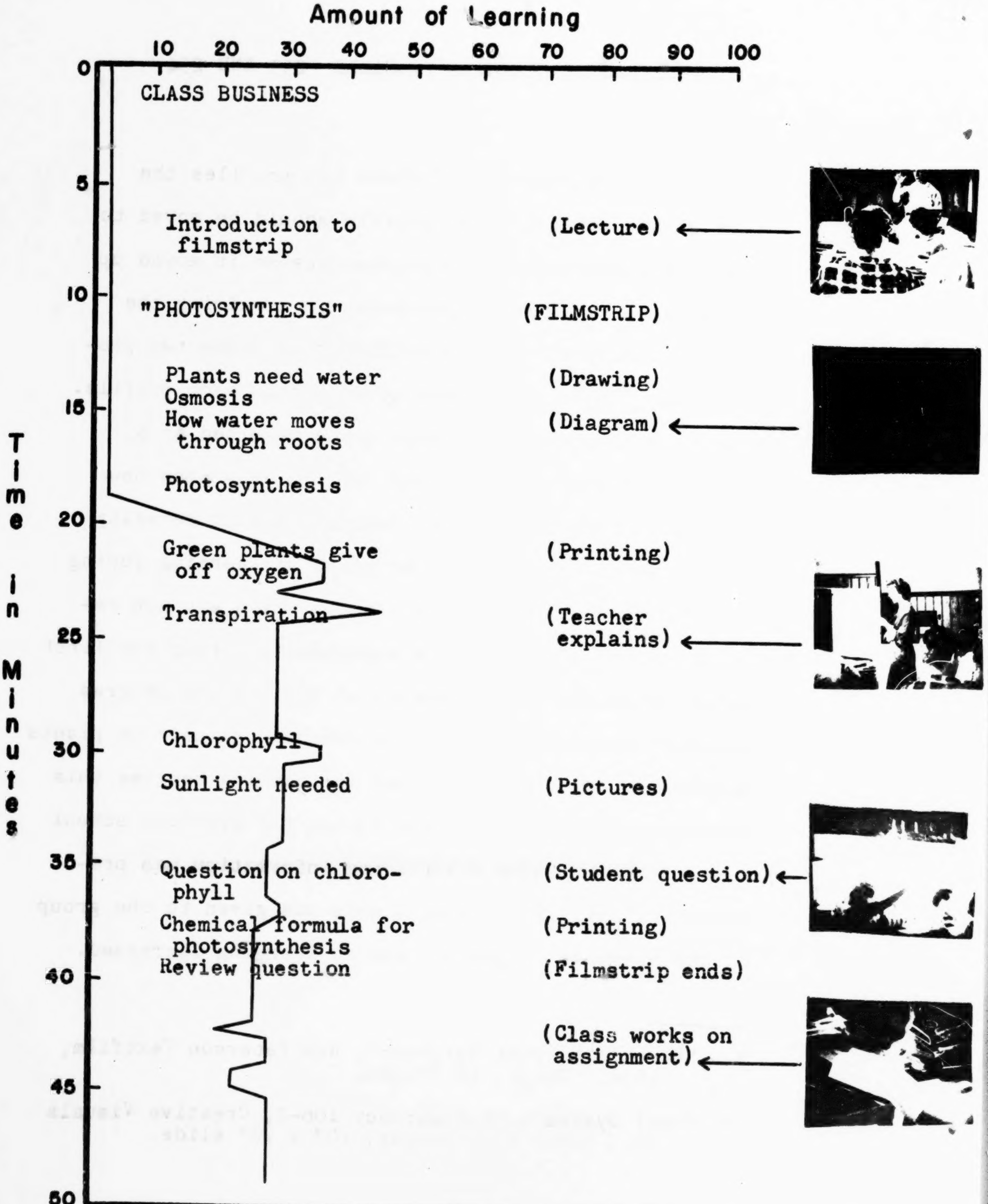
ANALYSIS OF LEARNING PROFILES 253 AND 254

For interpretation of these two profiles the line of the Control Group profile should be moved to the left approximately 30 points because it moved up higher as a result of adjustments in repairing the program analyzer. Most significant in these two profiles was the extent of variation within each profile. A group discussion of a study guide resulted in a fairly high level of learning particularly when new information was taken up in connection with heredity (C 253, 22). There were some peaks of learning during a filmstrip presentation on a topic which was not related to the unit*. In the Experimental Group the first large variations were a result of testing the program analyzer equipment. Use of an overhead slide** on plants resulted in no great increases in learning because this information had been studied during the previous school year. Slightly more complicated information was presented (E 253, 37-42) when a quiz was given to the group on the overhead projector, and so learning increased.

---

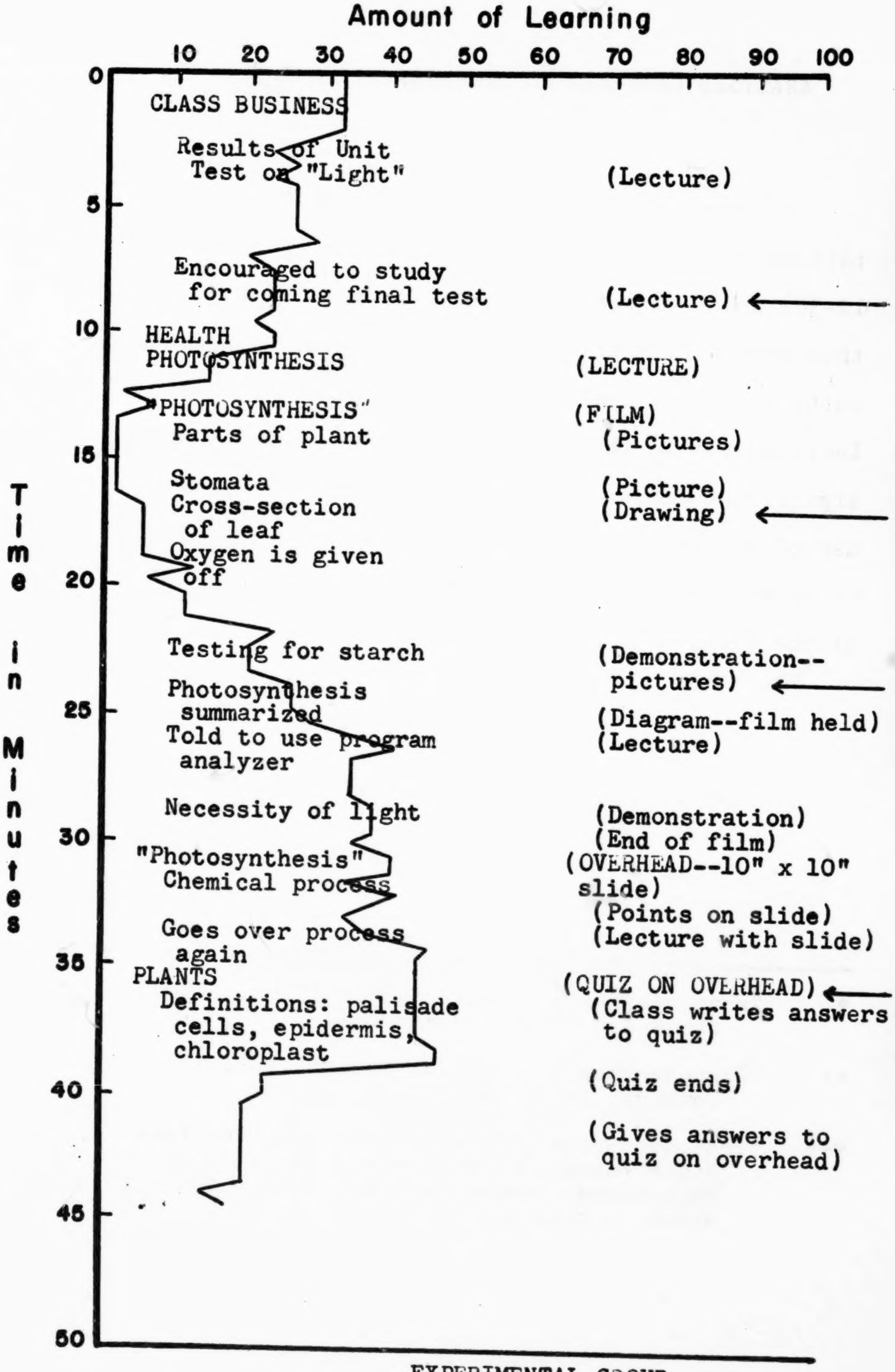
* "Earth's Nearest Neighbor", Row Peterson Textfilm, 1956. Color, 48 frames.

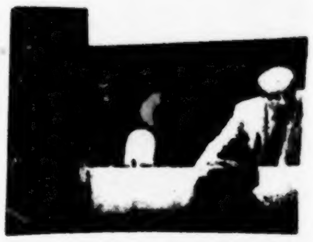
** "Leaf System", Transparency 106-2, Creative Visuals Co., n.d. Multi-color, 10" x 10" slide.

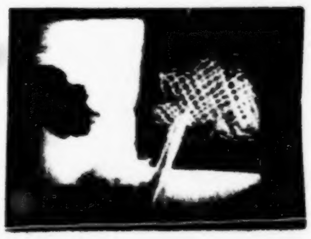


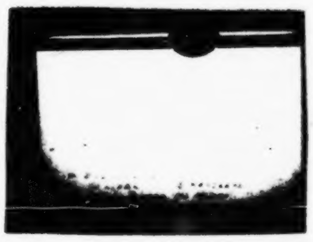
CONTROL GROUP

LEARNING PROFILE NUMBER 255









EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 256

ANALYSIS OF LEARNING PROFILES 255 AND 256

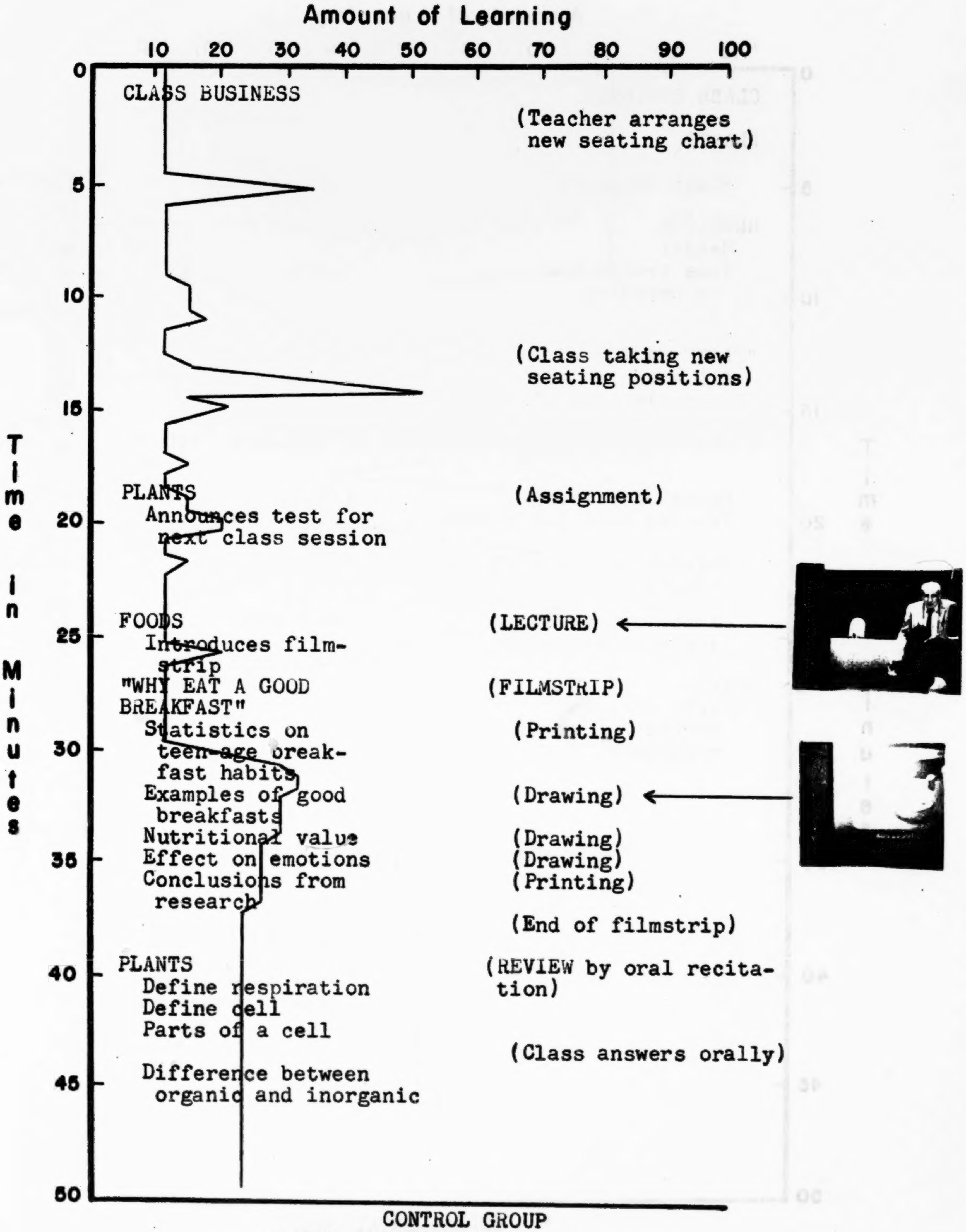
A motion picture film* resulted in a similar pattern of learning in an Experimental Group (E 256, 12-30) when compared to a Control Group (C 255, 11-40) that used a filmstrip**. In both cases the beginning portions of the learning media resulted in little learning but in the last protion learning reached significant peaks. In the Experimental Group the use of an overhead transparency*** caused learning to be maintained at a high level even after the end of the film.

---

* "Photosysthesis", United World Films, 1950. Black and white, 18 minutes.

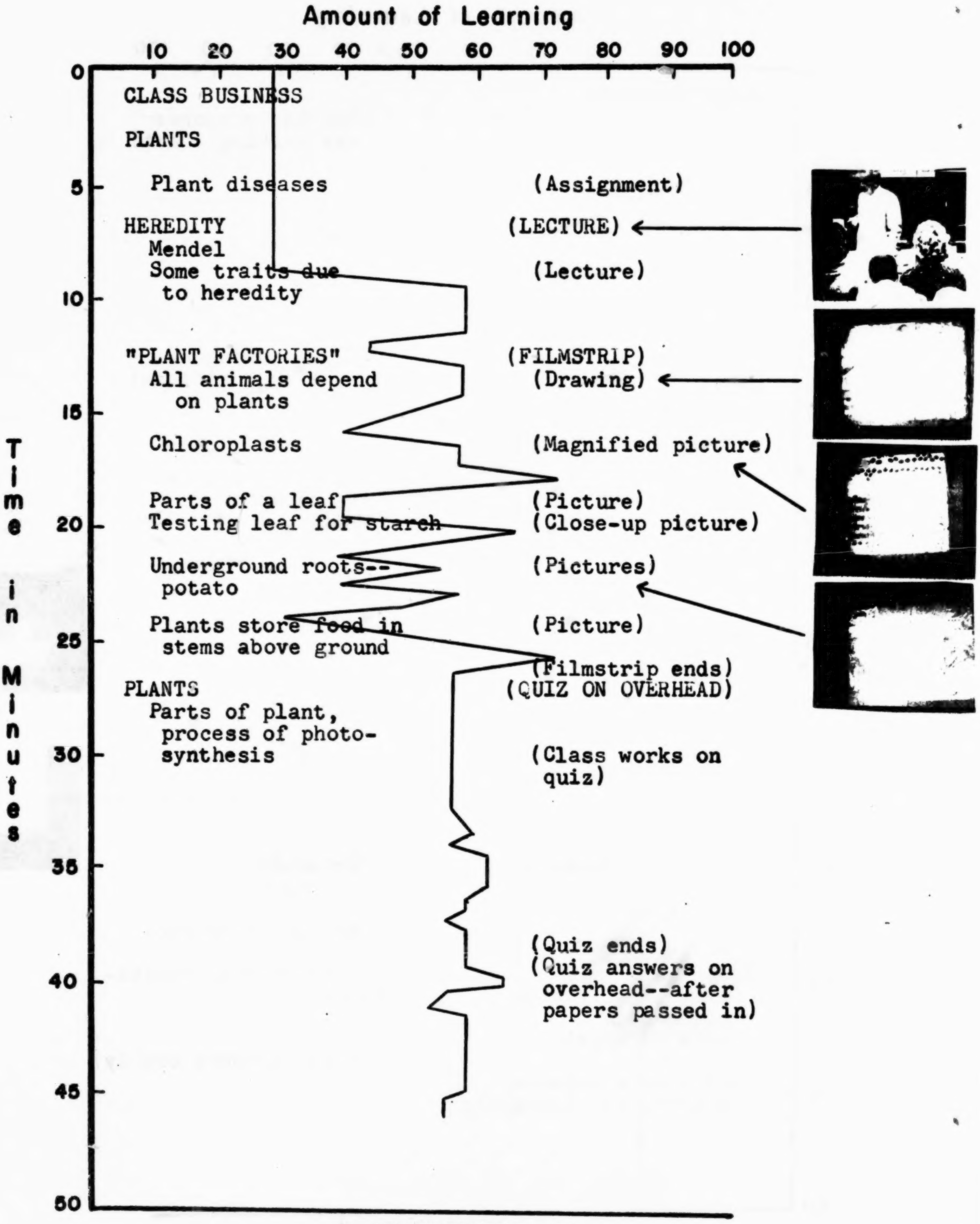
** "Photosynthesis", Popular Science Publishing Company, 1952. Color, 51 frames.

*** "Photosynthesis", Transparency XIH, New York State Education Department, Division of Educational Communications, 1961. 10" x 10" slide, 4 colors.



CONTROL GROUP

LEARNING PROFILE NUMBER 257



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 258

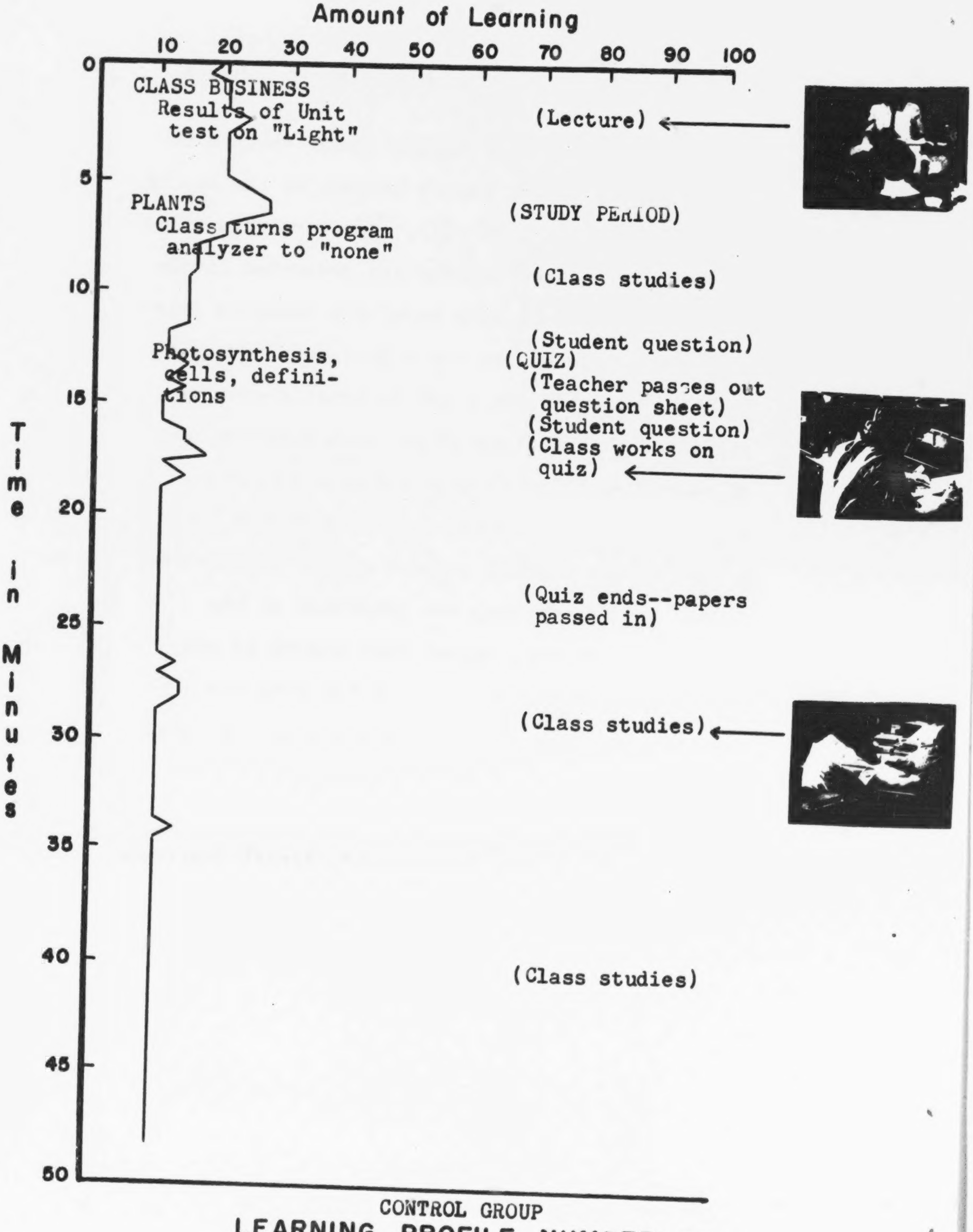
ANALYSIS OF LEARNING PROFILES 257 AND 258

Learning during a Control Group reached no great heights during either lecture or the use of a filmstrip* (C257, 28--38). However, this filmstrip was presented rapidly and presented little new information. A more carefully selected filmstrip was presented to the Experimental Group.** In this filmstrip there was no great degree of significant variations in learning with the use of magnified illustrations and close-up photographs. During the last part of a period, as a part of the regular pattern of the Experimental Group, each day a quiz was presented on the overhead projector; papers were turned in and the answers were given so that the students were able to know immediately how well they did.

---

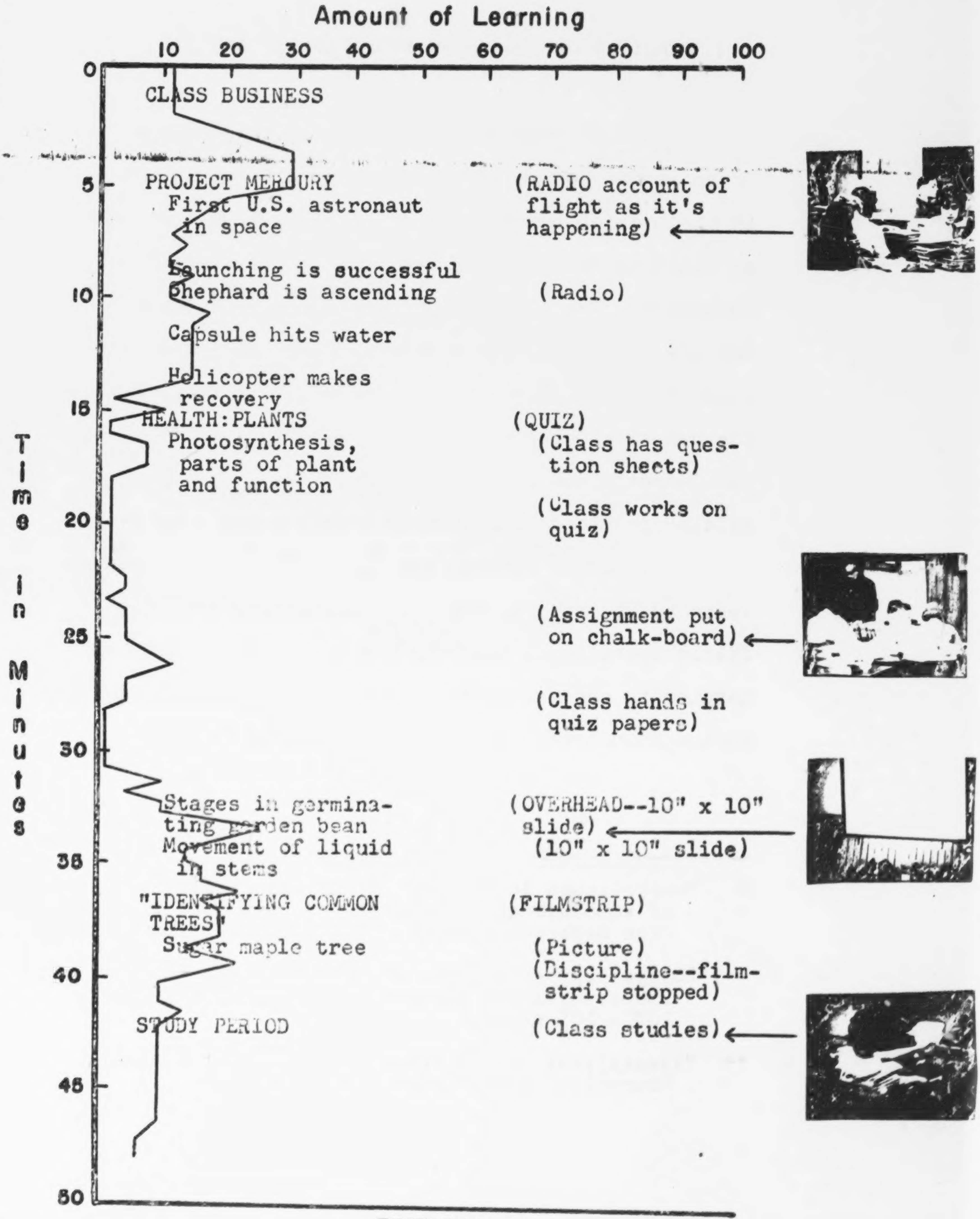
* "Why Eat A Good Breakfast?", Cereal Institute Inc., n.d. 34 frames, color.

** "Plant Factories", Row Peterson, color, 44 frames, 1951.



CONTROL GROUP

LEARNING PROFILE NUMBER 259



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 260

ANALYSIS OF LEARNING PROFILES 259 AND 260

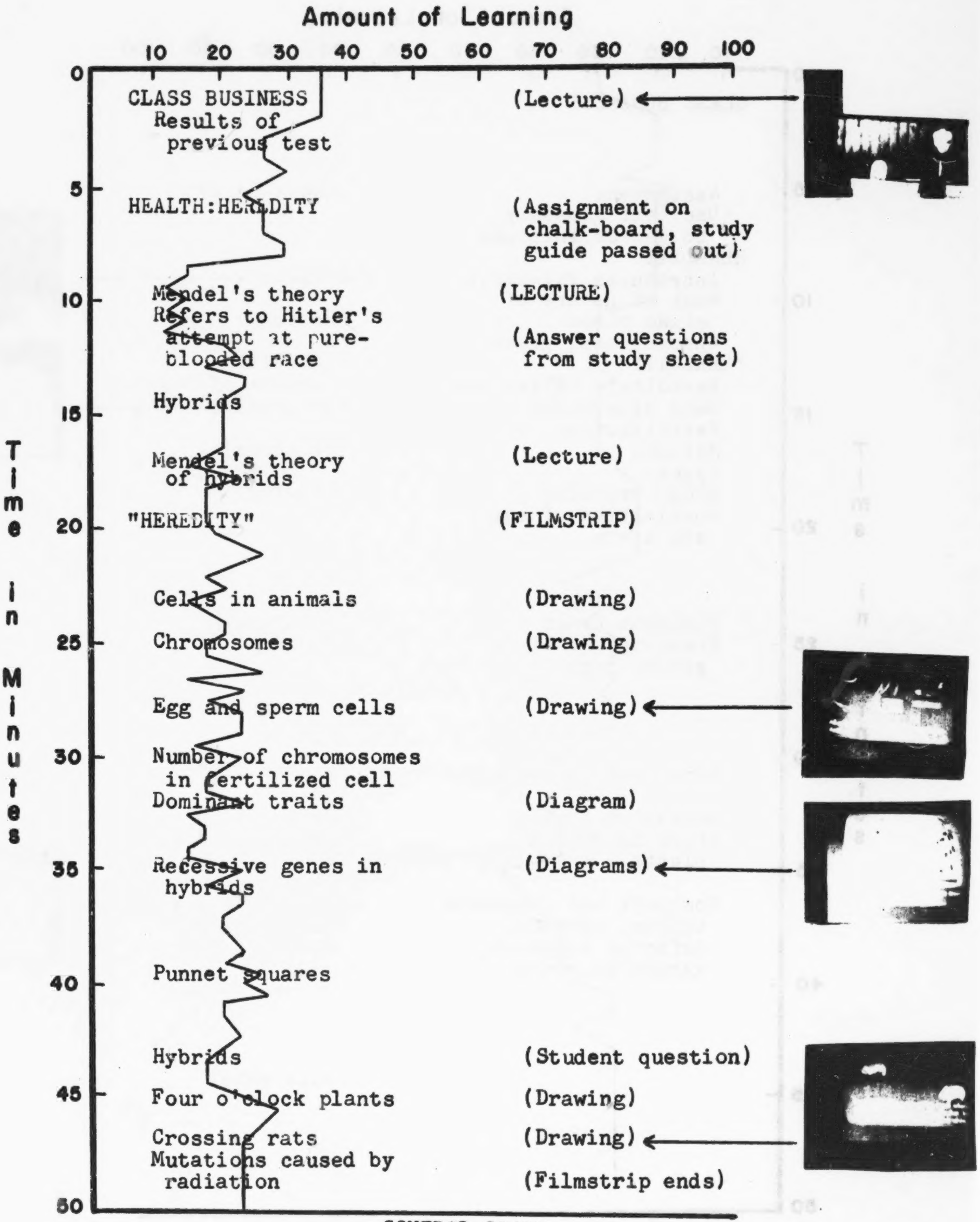
Review of present information in the Control Group at the beginning of the class did not result in the peak of learning which resulted from the use of radio to report the space trip of the first U.S. Astronaut. The fact that the man went into space was new information so a peak of learning resulted; however, learning did not maintain a high level during the description of the event since the students were not learning new data. The use of two overhead slides* resulted in a peak of learning and some peaks of learning were reached during a filmstrip*. However, learning reached no great heights because this was fairly specialized material and very little time was devoted to the presentation with an unplanned study period introduced as a disciplinary measure.

---

* "Circulation in Plants," Transparency XID, Division of Educational Communications, New York State Education Department, 1961. 2 colors, 10" x 10" slide.

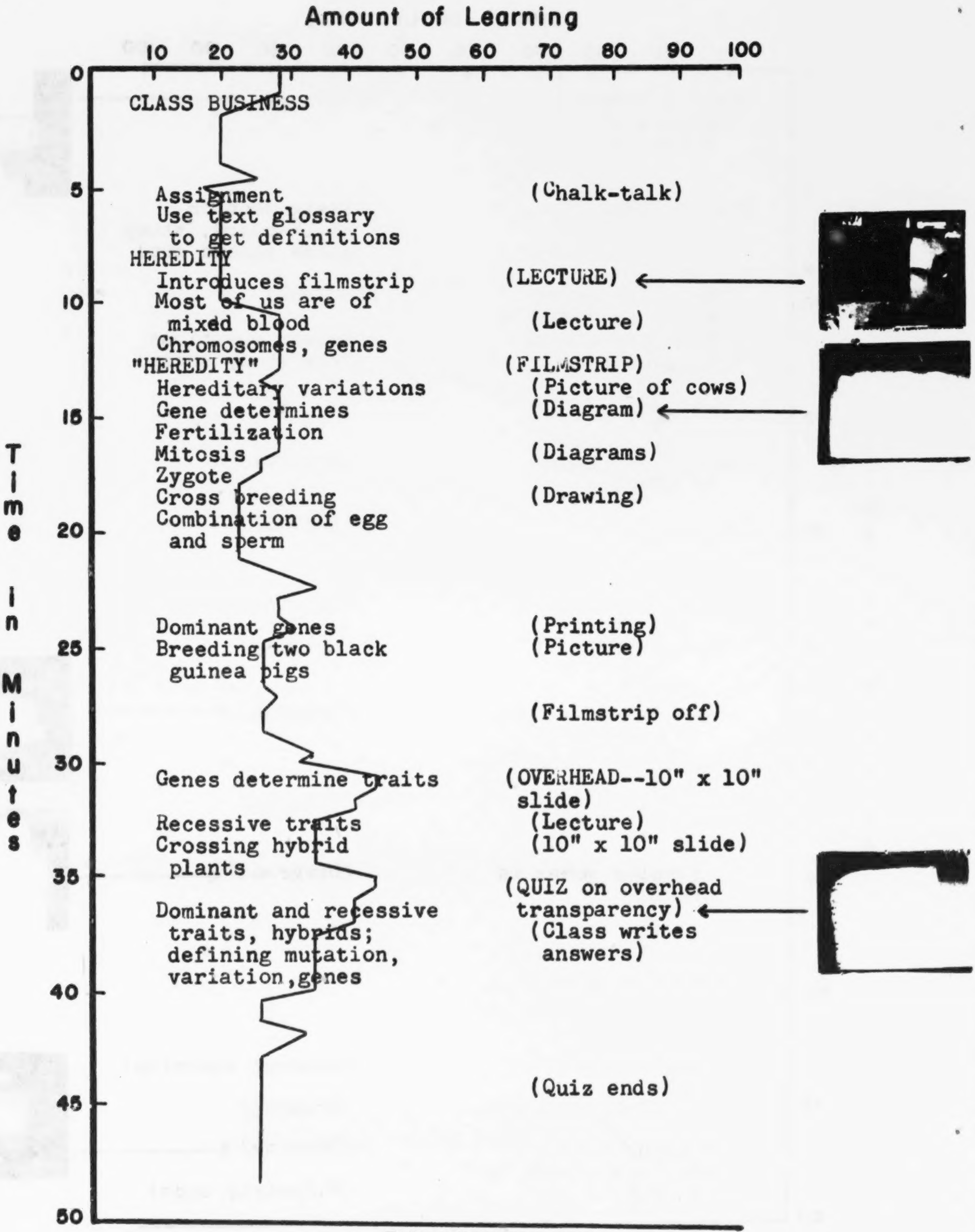
"Stages in Germination of Garden Bean", Transparency 106-4, Creative Visuals Co., n.d. Multi-color, 10" x 10" slide.

** "Identifying Common Trees", Society for Visual Education, 1959. Color, 28 frames.



CONTROL GROUP

LEARNING PROFILE NUMBER 261



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 262

ANALYSIS OF LEARNING PROFILES 261 AND 262

The two groups of presentation were very similar beginning with lecture and continuing with a filmstrip. However, the profile was slightly higher during the filmstrip of the Experimental Group because a more carefully selected filmstrip* was introduced (E262, 13--28). The filmstrip** in the Control Group required a longer period of time and was slightly less effective even though it was in color.

In the Experimental Group the use of an overhead transparency*** resulted in a high peak of learning (E262, 31) and this was particularly significant since it helped to clarify a point which was not high in the Control Group (C261, 32). Learning stayed at a fairly high level during the presentation of the other transparency#. It is by the fact that these were presented very rapidly before a quiz which followed.

---

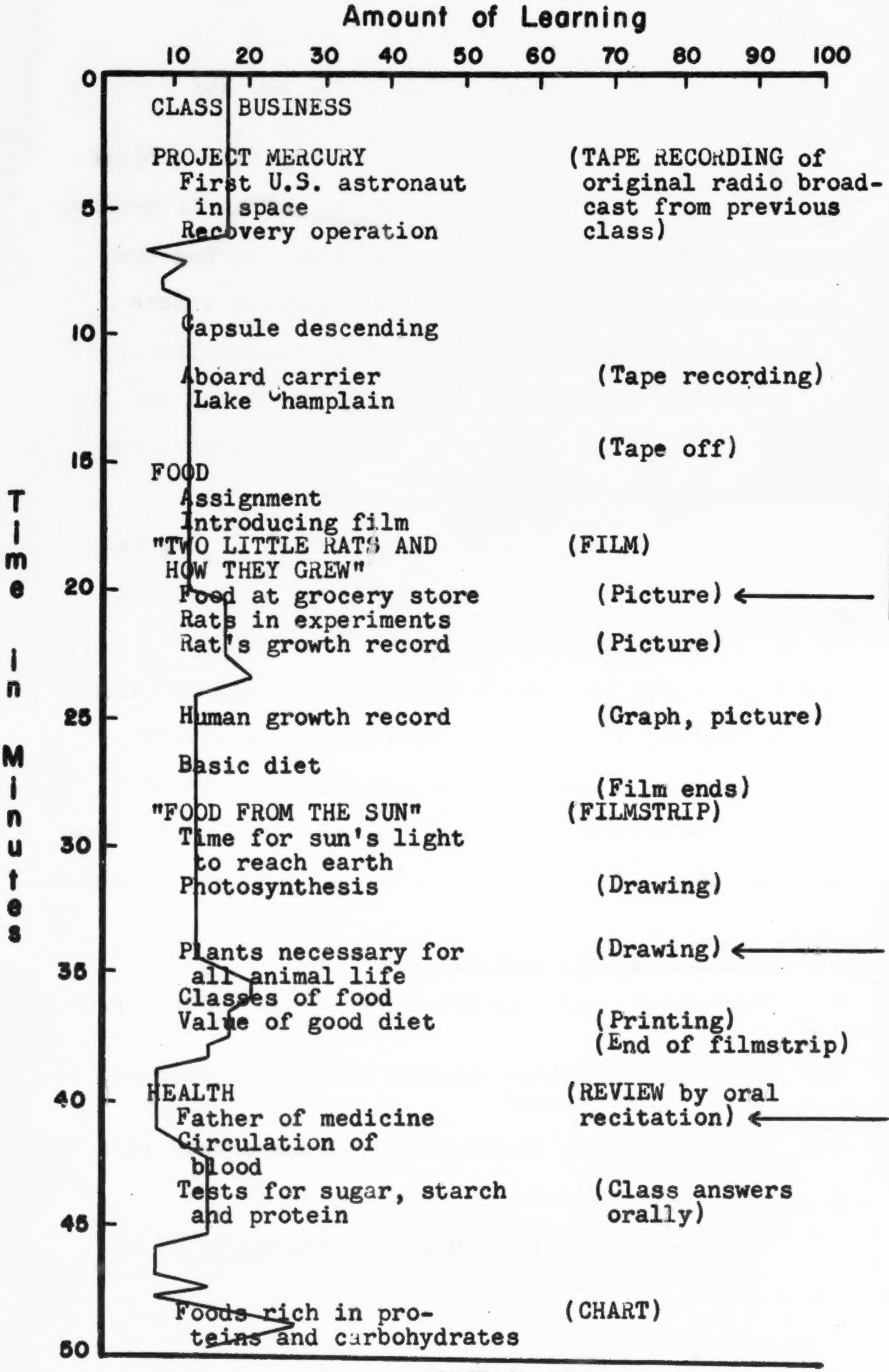
* "Heredity", Encyclopedia Britannica, 1950. Black and white.

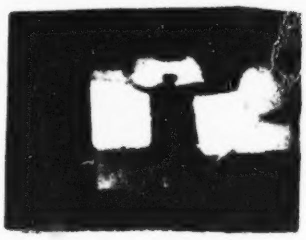
** "Heredity", Popular Science Publishing Company, 1955. 46 frames, color.

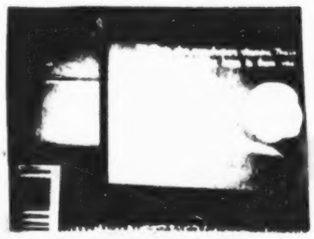
*** "Traits, Genes, Chromosomes", Transparency XI i

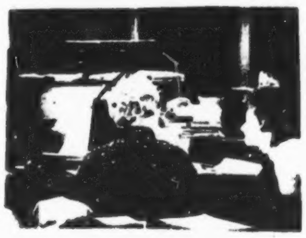
# "Mendel's Explan", Transparency XI H

"Dominance, Recessiveness", Transparency XI J



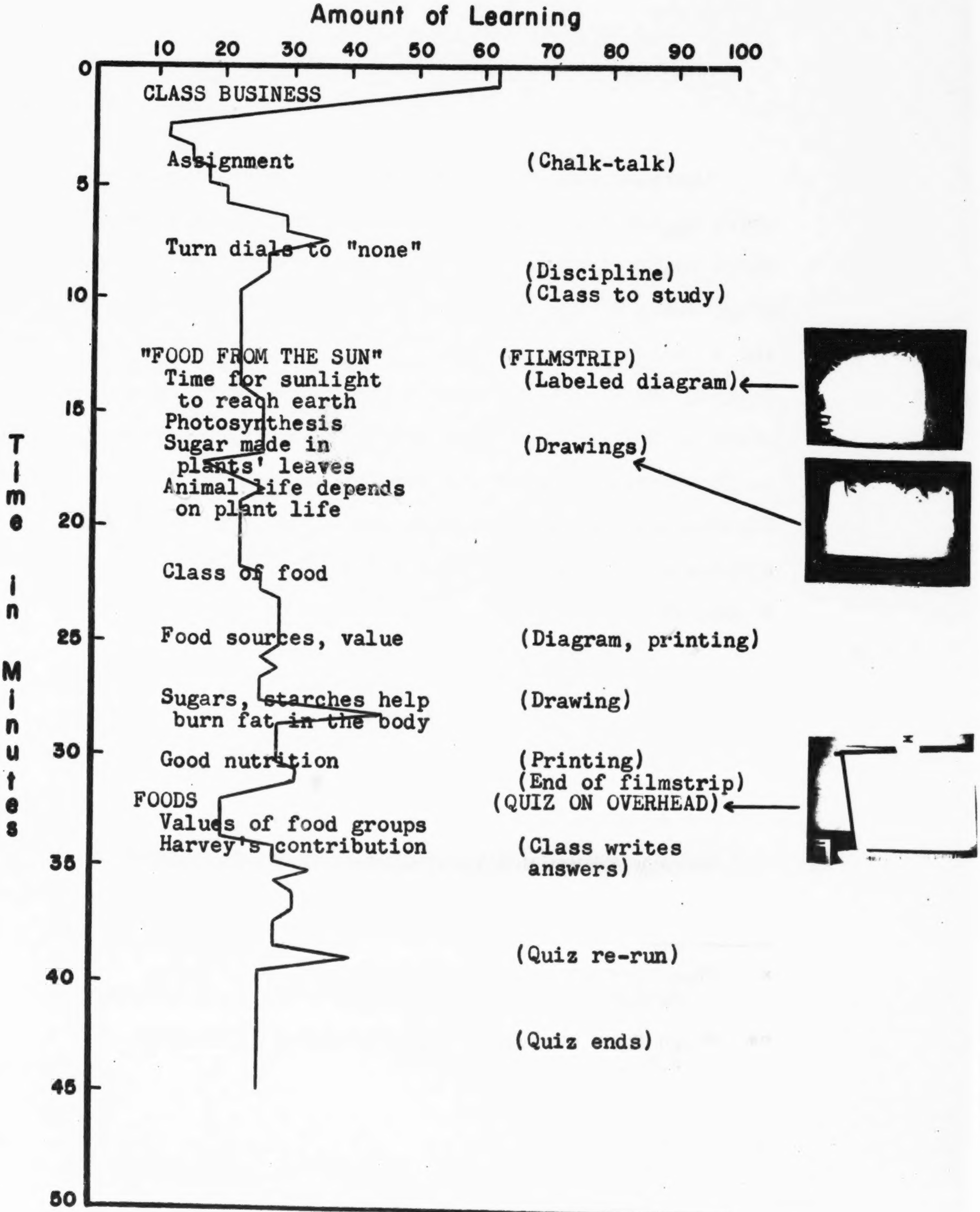






CONTROL GROUP

LEARNING PROFILE NUMBER 263



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 264

ANALYSIS OF LEARNING PROFILES 263 AND 264

Learning was greater in the Experimental Group where students were able to concentrate on one filmstrip rather than several presentations in the Control Group where a tape recording was followed by a film* and a review by recitation. The highest point in the Control Group occurred when reference was made to a chart (C 263, 49). A high peak of learning occurred in the presentation of the same filmstrip** in the Experimental Group where time was allowed for more efficient coverage (the high point is located in E 264, 28).

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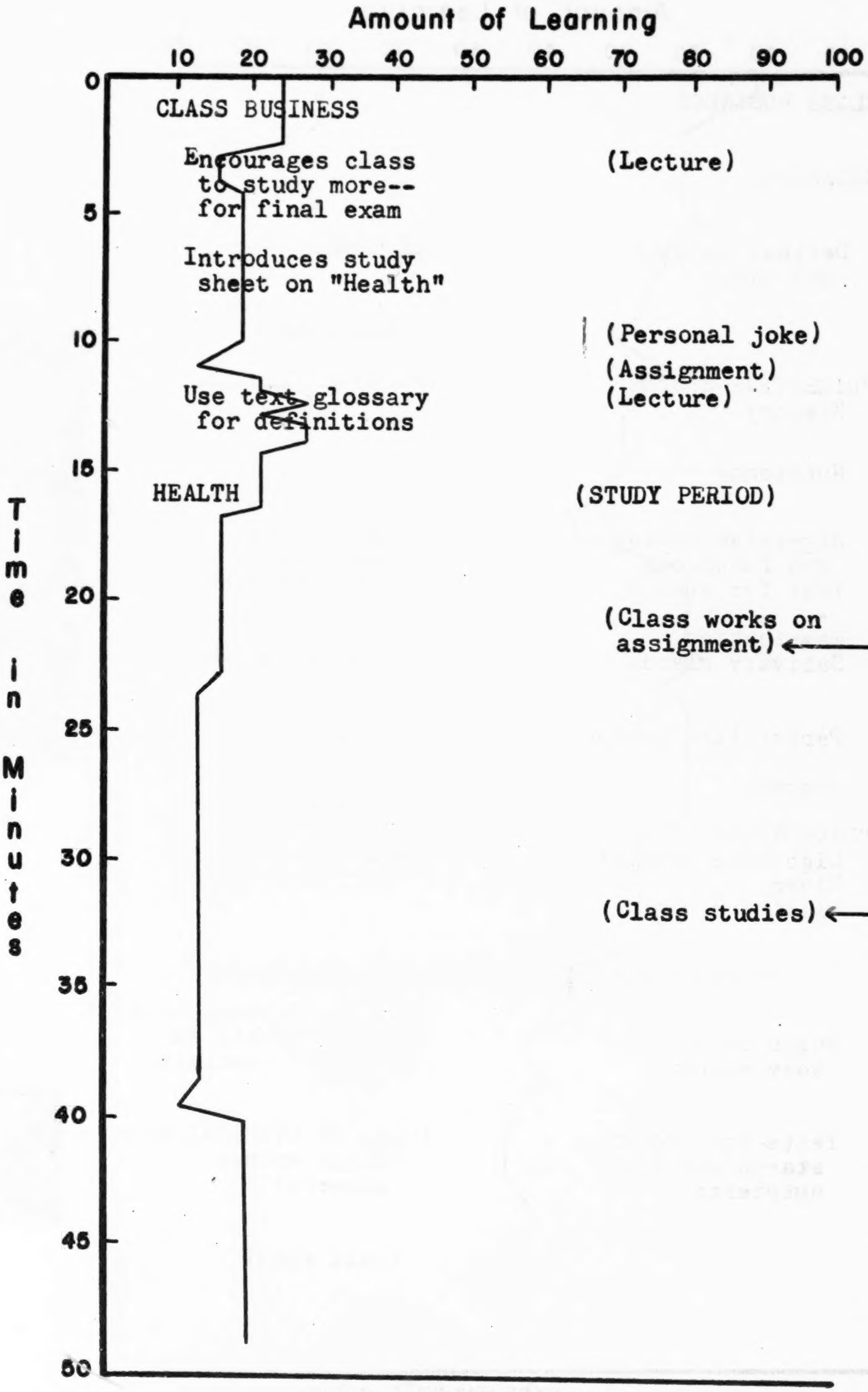
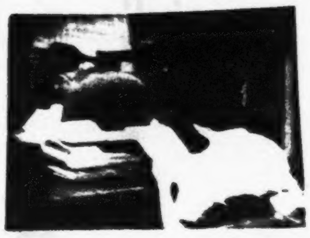
* "Two Little Rats, How They Grew", W.M. Welch Manufacturing Company, 1949. Color, 9 minutes.

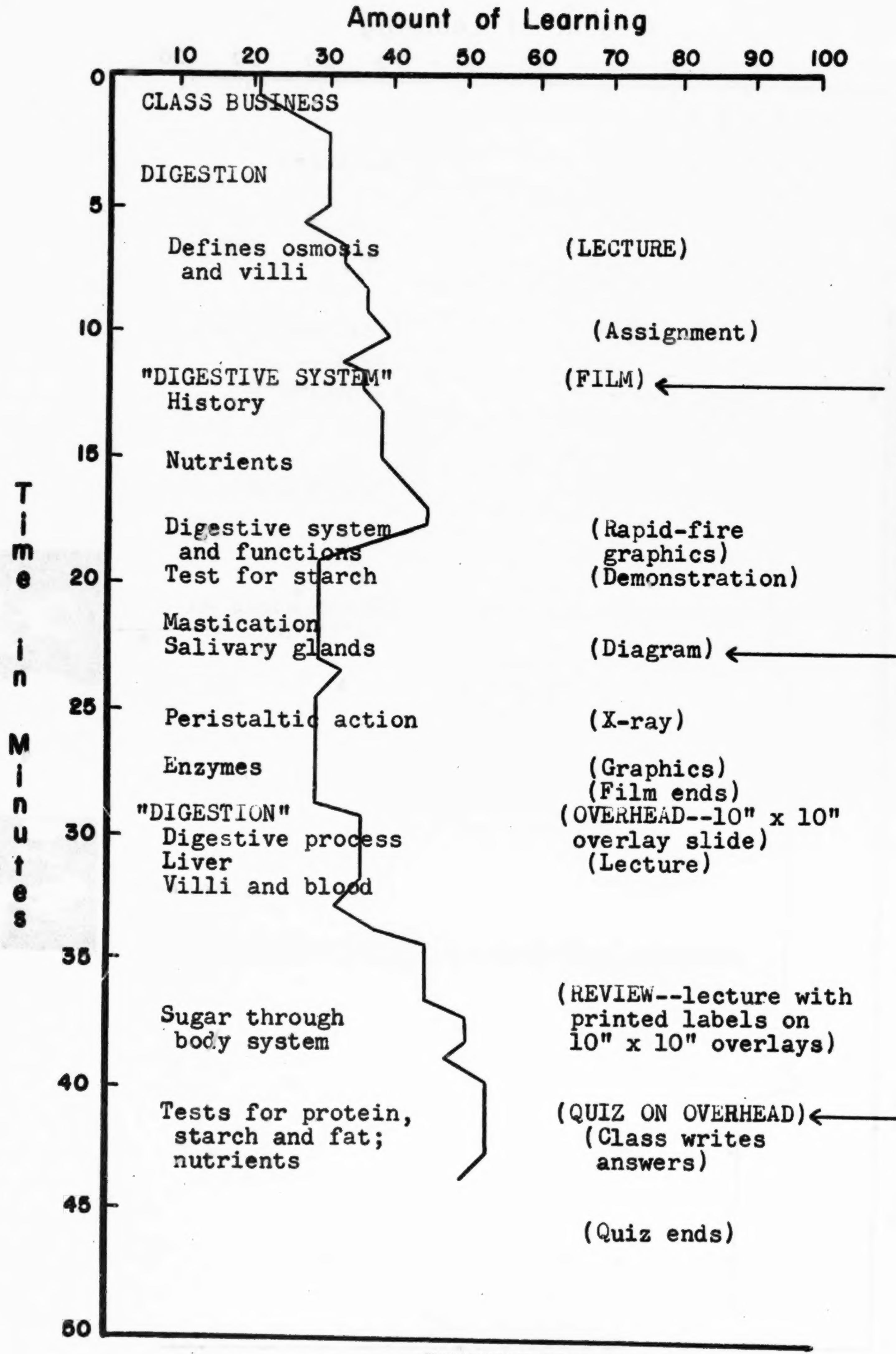
** "Food From the Sun", Sugar Research Foundation, N.D., Color, 42 frames.

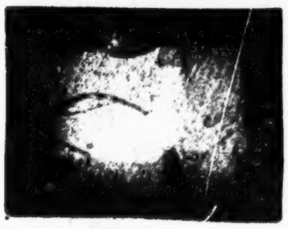




CONTROL GROUP

LEARNING PROFILE NUMBER 265





EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 266

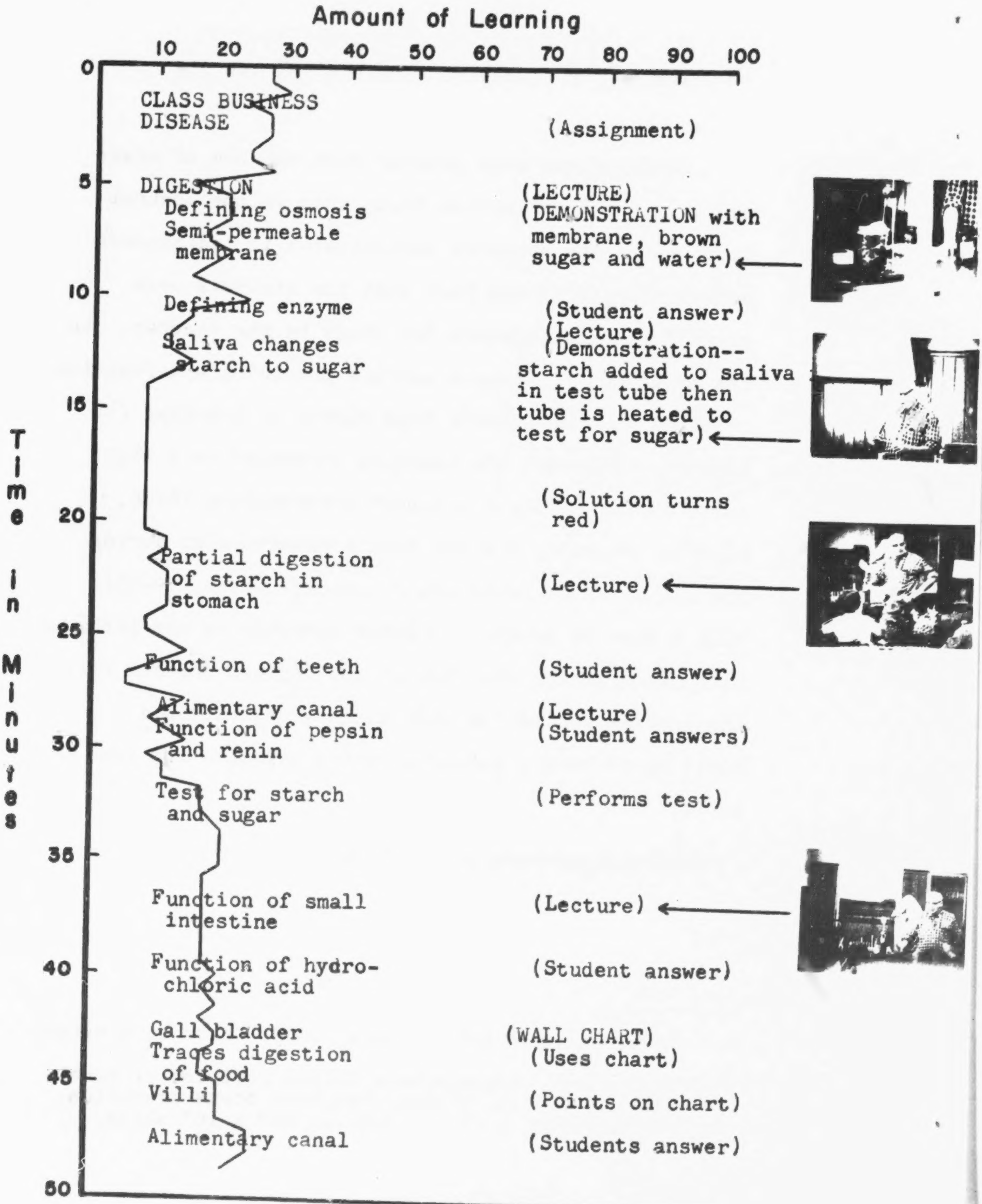
ANALYSIS OF LEARNING PROFILES 265 AND 266

Learning was much greater with the use of newer media in the Experimental Group than in the Control Group where the students participated in independent study in spite of the fact that the students were given much encouragement for study by the teacher. In the Experimental Group a lecture providing a definition resulted in a relatively high degree of learning for lecture. However, the learning increased to a high point during a motion picture* presentation (E266, 12-28). Learning reached even a higher point during the use of an overhead transparency** (E266, 29-39). With a test on material related directly to the particular class period resulted in the highest portion of the profile indicating that a class activity had built up to this , making a test a capstone for the topic.

---

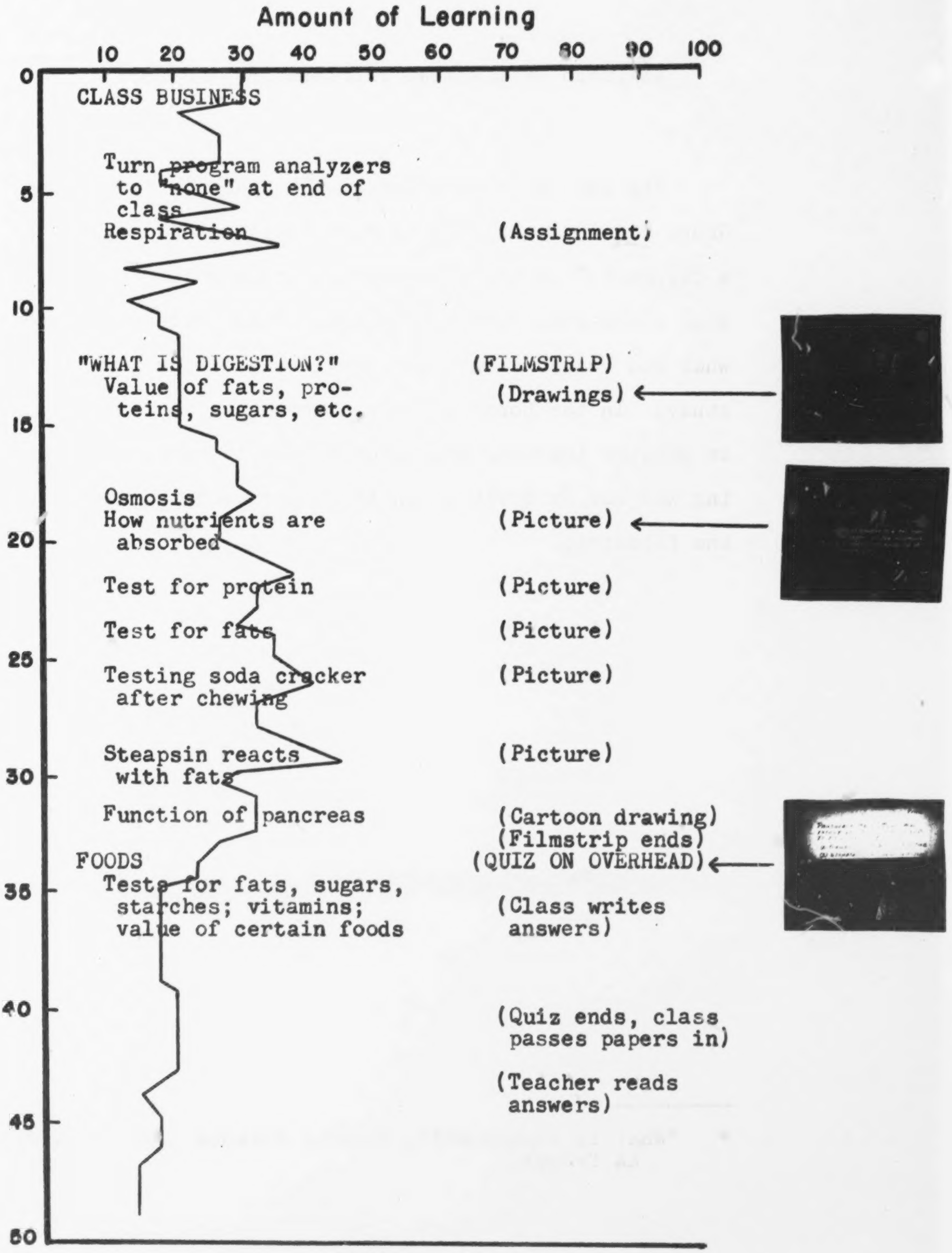
* "Digestive System", Coronet, 1958. Color 14 minutes.

** "Digestion", Transparency XIIAA, Division of Educational Communications, New York State Education Department, 1961. 4 colors, 10" x 10" slide.



CONTROL GROUP

LEARNING PROFILE NUMBER 267



EXPERIMENTAL GROUP

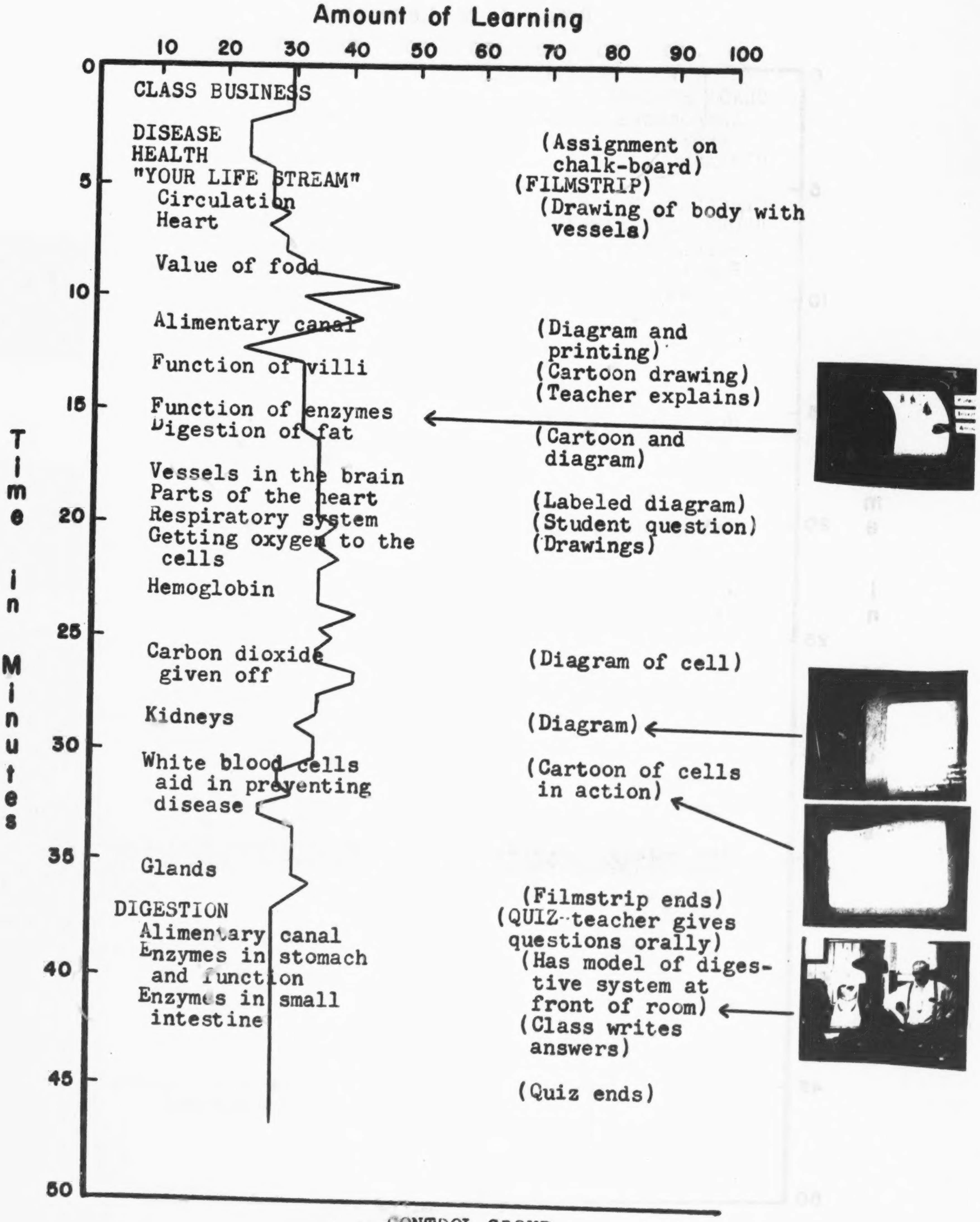
LEARNING PROFILE NUMBER 268

ANALYSIS OF LEARNING PROFILES 267 AND 268

The use of lecture and a wall chart in the Control Group did not result in as much learning as provided by a filmstrip* in the Experimental Group which included some clear-cut, simple drawings. This pattern repeated what had occurred one year previously during the pilot study. In the Control Group a demonstration resulted in greater learning than provided by lecture, but learning was not as great as in the Experimental Group with the filmstrip.

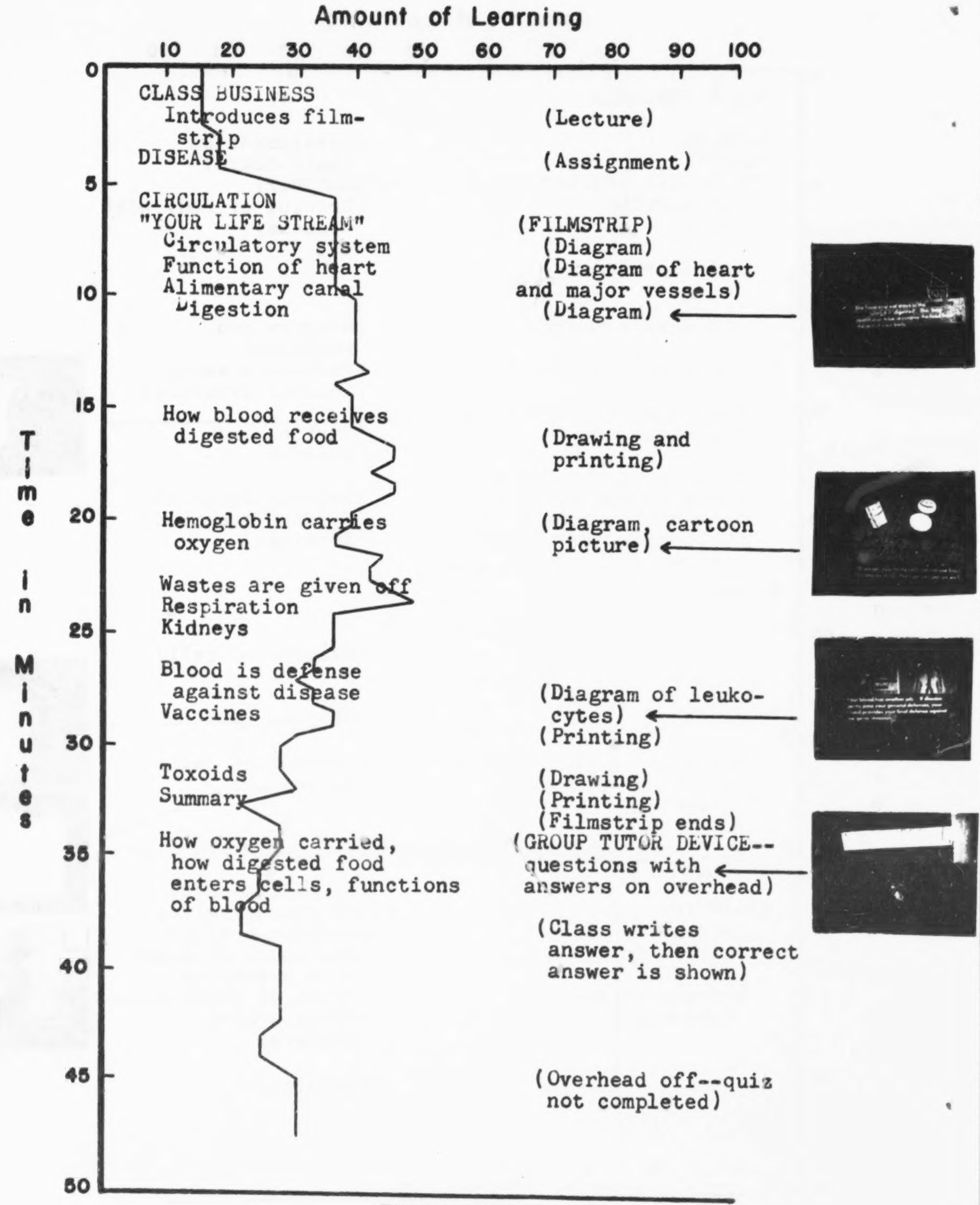
---

* "What is Digestion?", Popular Science, 1953. Color, 44 frames.



CONTROL GROUP

LEARNING PROFILE NUMBER 269



EXPERIMENTAL GROUP

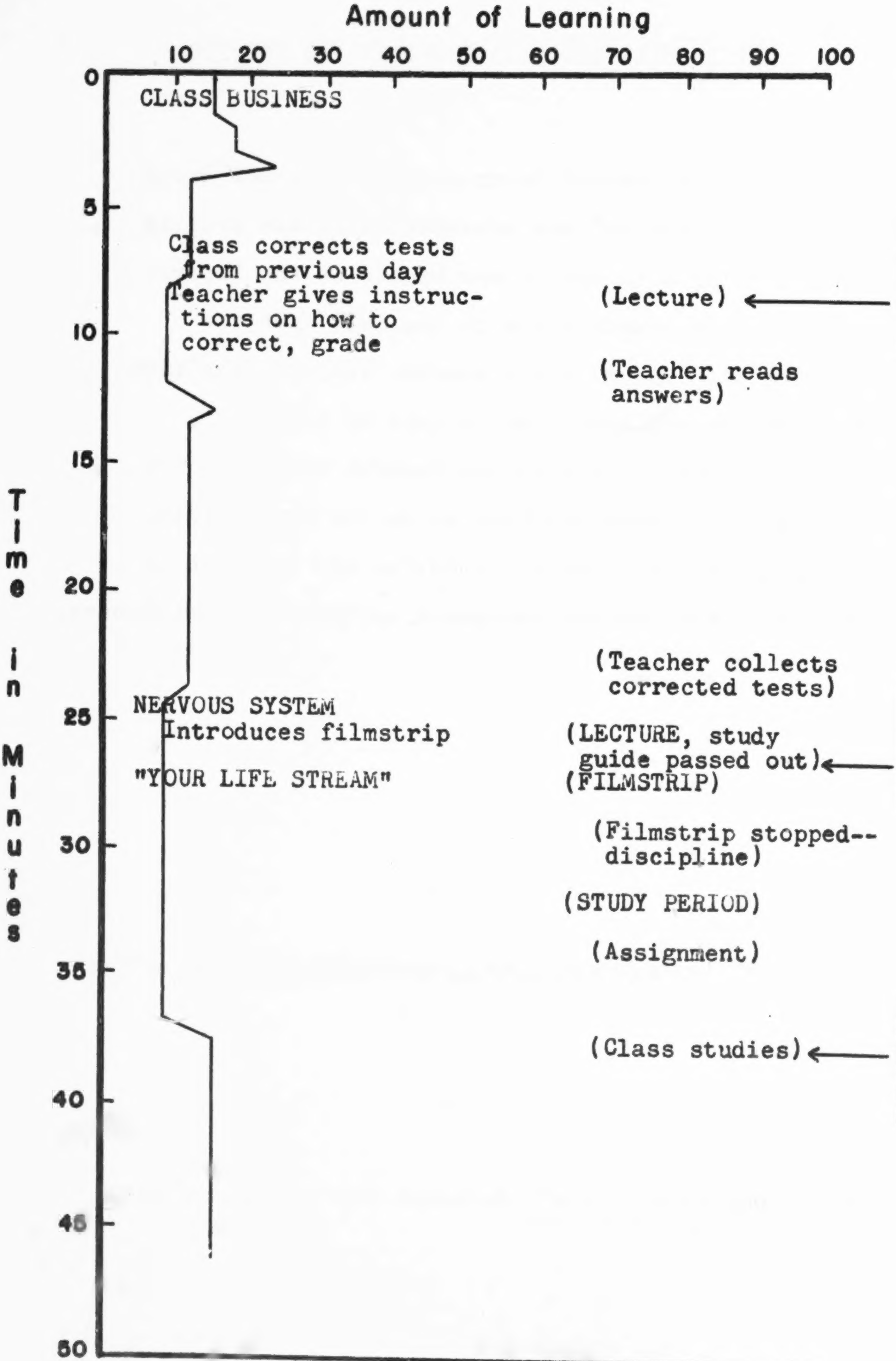
LEARNING PROFILE NUMBER 270

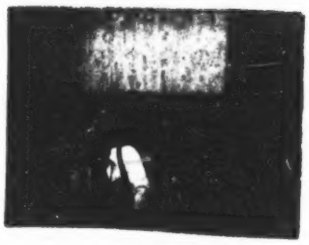
ANALYSIS OF LEARNING PROFILES 269 AND 270

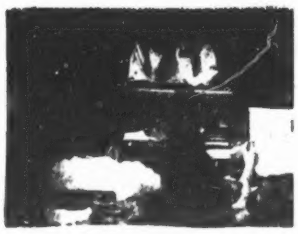
In both Control Group and Experimental Group the same filmstrip* was presented with the profile very similar although it was higher in the Experimental Group possibly due to the fact that the presentation was slightly shorter leaving less time for teacher explanations. A quiz by means of a paper and pencil test in the Control Group did not result in as much learning as in the Experimental Group where the group tutor device was utilized to provide questions and immediate correction of responses.

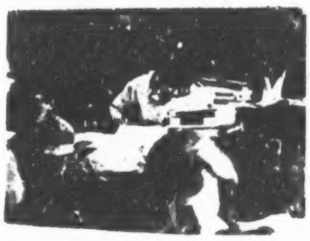
---

* "Your Life Stream", Harbrace Court Company, 1957. Color, 35 frames.

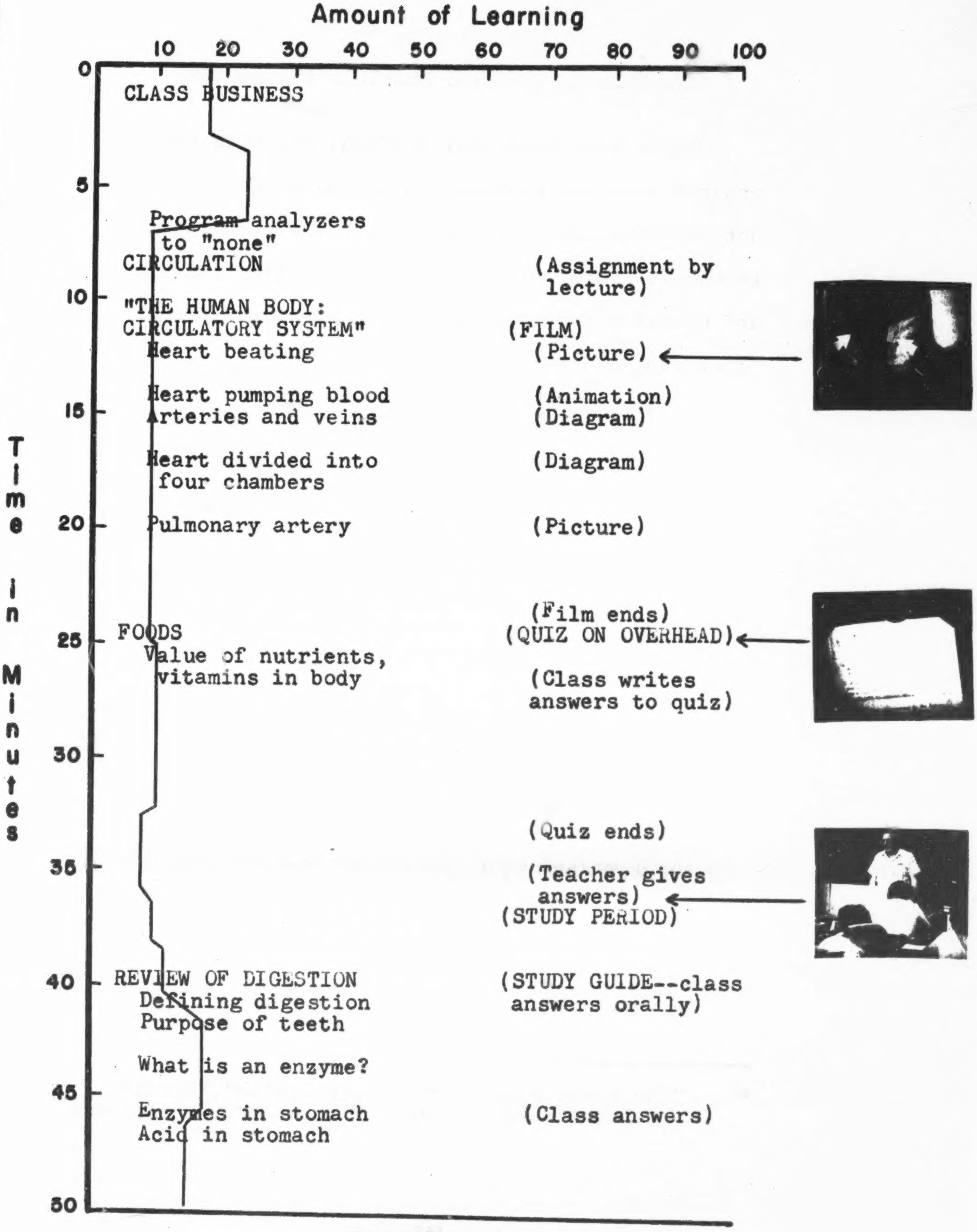








CONTROL GROUP
LEARNING PROFILE NUMBER 271



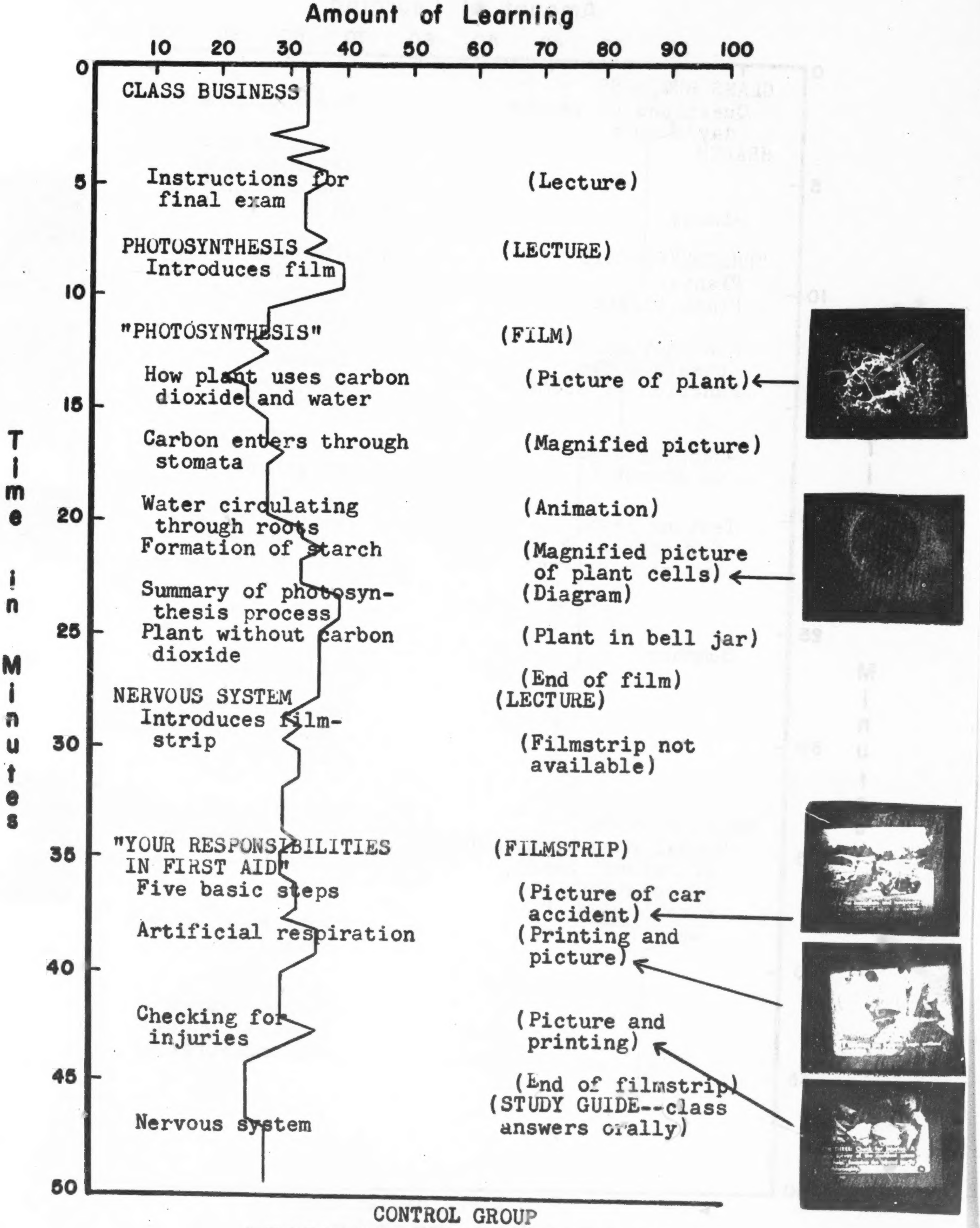
EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 272

ANALYSIS OF LEARNING PROFILES 271 AND 272

There were technical difficulties with the program analyzer equipment which made the profiles not accurate for interpretation. They are included to show the progression of subject matter content and teaching procedures. A film was used in the Experimental Group*.

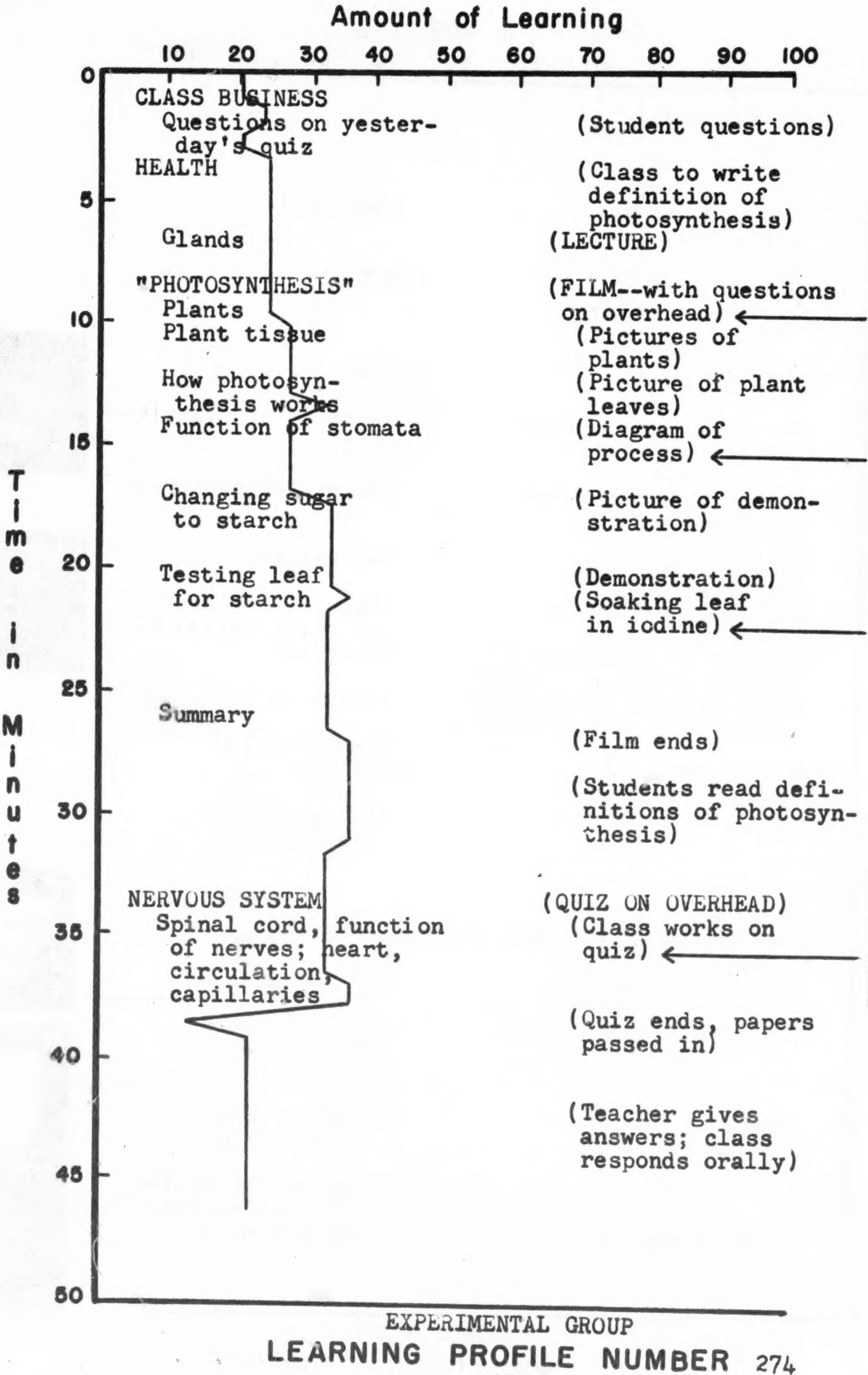
---

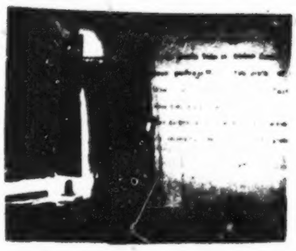
* "The Human Body; Circulatory System", Coronet Instruction. Film, 1956, color, 14 minutes.

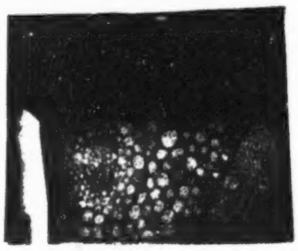


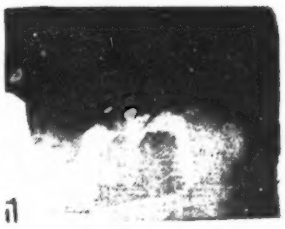
CONTROL GROUP

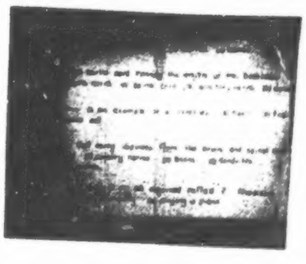
LEARNING PROFILE NUMBER 273











EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 274

ANALYSIS OF LEARNING PROFILES 273 AND 274

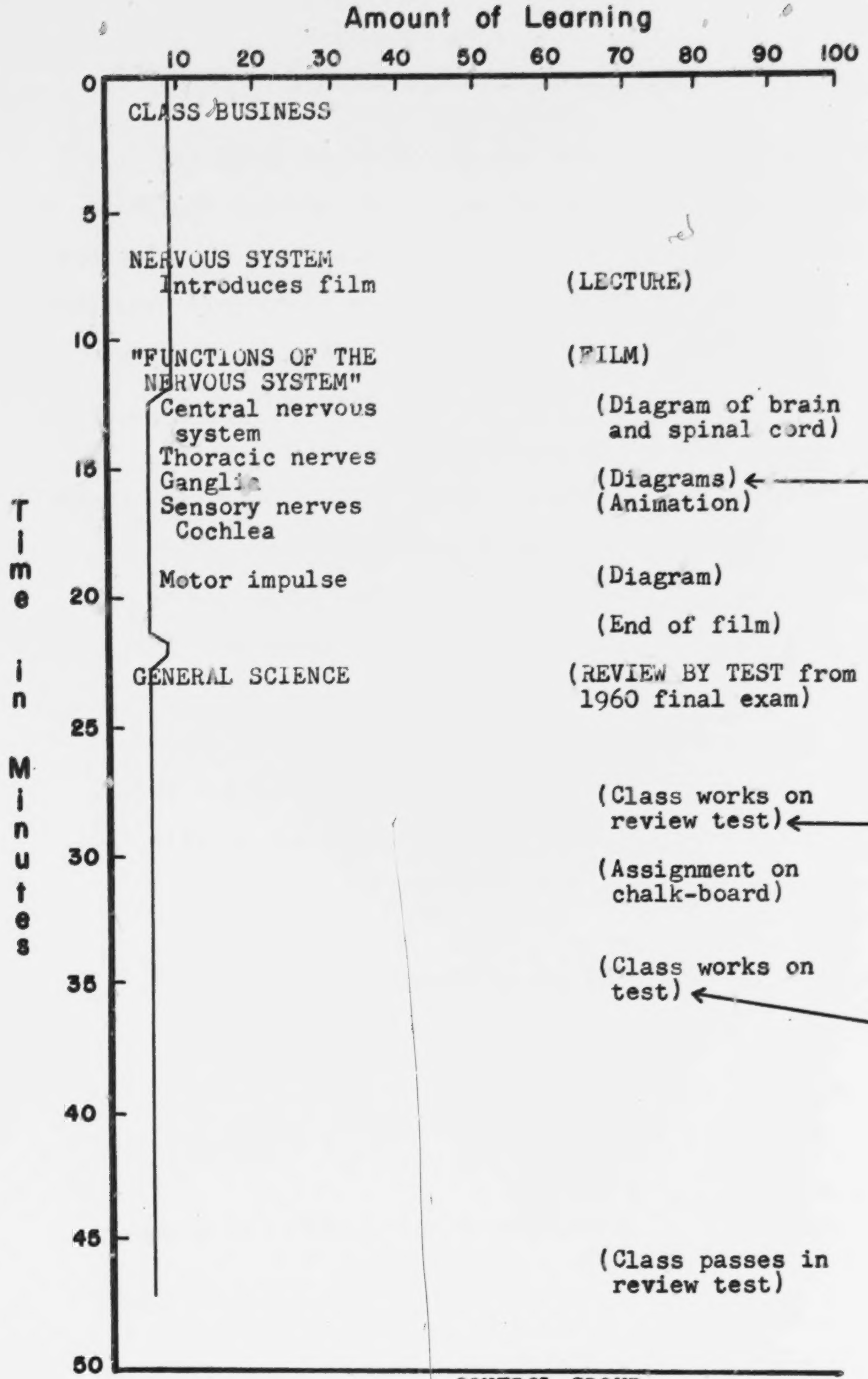
In both the Control and the Experimental Group the same motion picture* was presented; With learning beginning at a higher level in the Experimental Group where the students were also looking for answers to questions which were projected by means of overhead projector. However, the overall level of the profile was approximately the same in both groups. A summary with a diagram caused a peak of learning in the Control Group (C273, 23) which did not occur in the Experimental Group because the students have been able to concentrate as they went along in writing their answers to questions on the film. The Control Group utilized some unrelated material in the form of a filmstrip**.

In the Experimental Group the presentation of answers to a quiz which was projected on the overhead did not result in learning because the students were very familiar with the subject at this point.

---

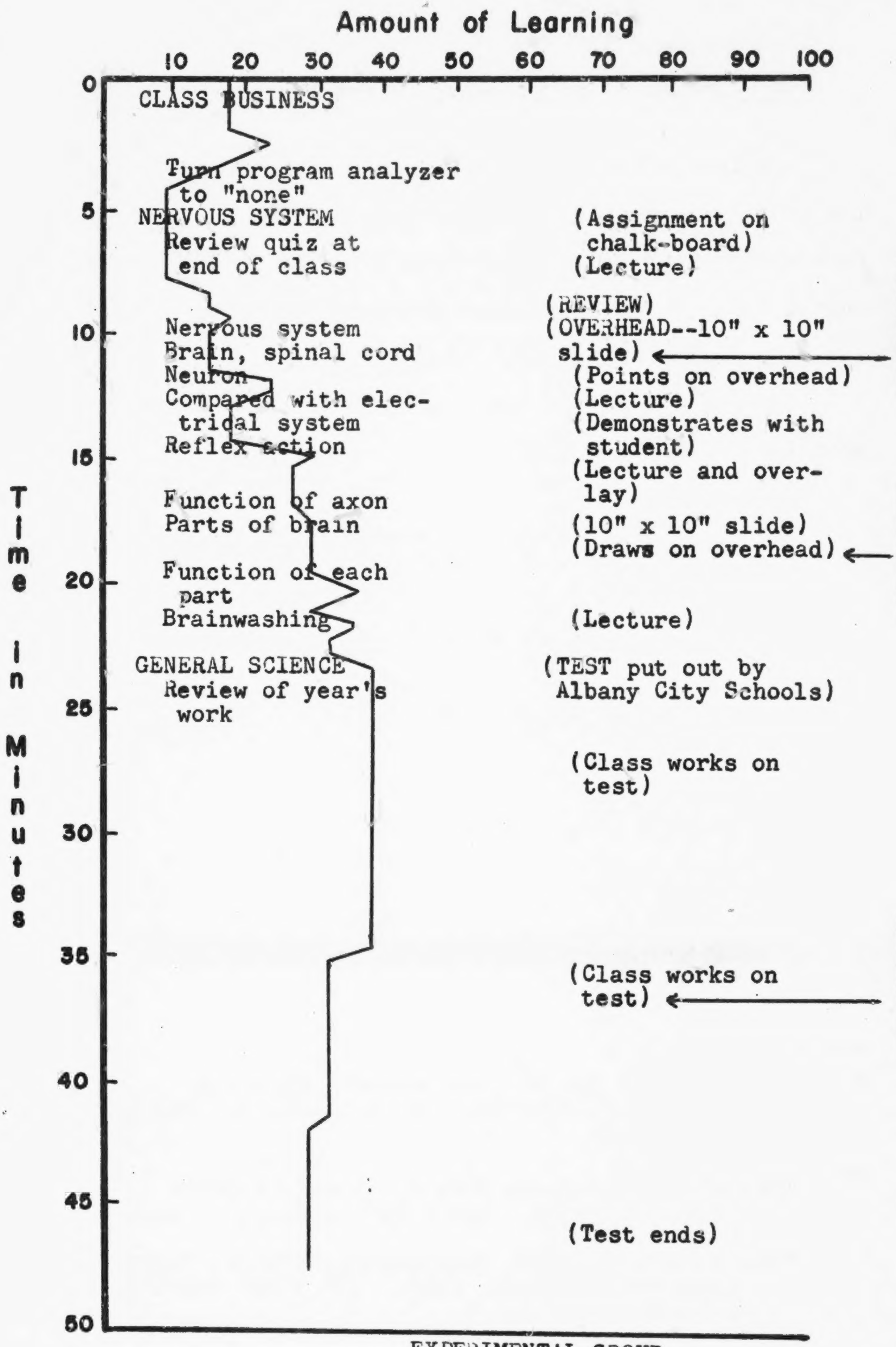
* "Photosynthesis", United World Film, 1952. 51 frames, color, 15 minutes.

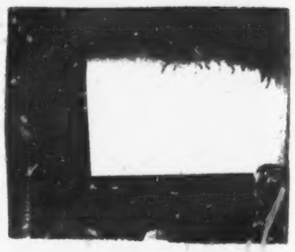
** "Your Responsibility in First Aid", Mc Graw-Hill, 1957. Black and white, 39 frames.

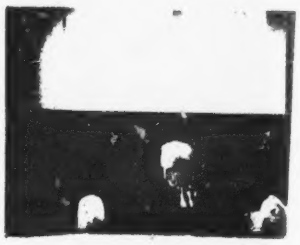


CONTROL GROUP

LEARNING PROFILE NUMBER 275







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 276

ANALYSIS OF LEARNING PROFILES 275 AND 276

A film* in the Control Group resulted in a very low level of learning after its introduction by lecture. In contrast learning reached higher levels in the Experimental as soon as lecture was completed and presentation was made utilizing overhead transparency.**

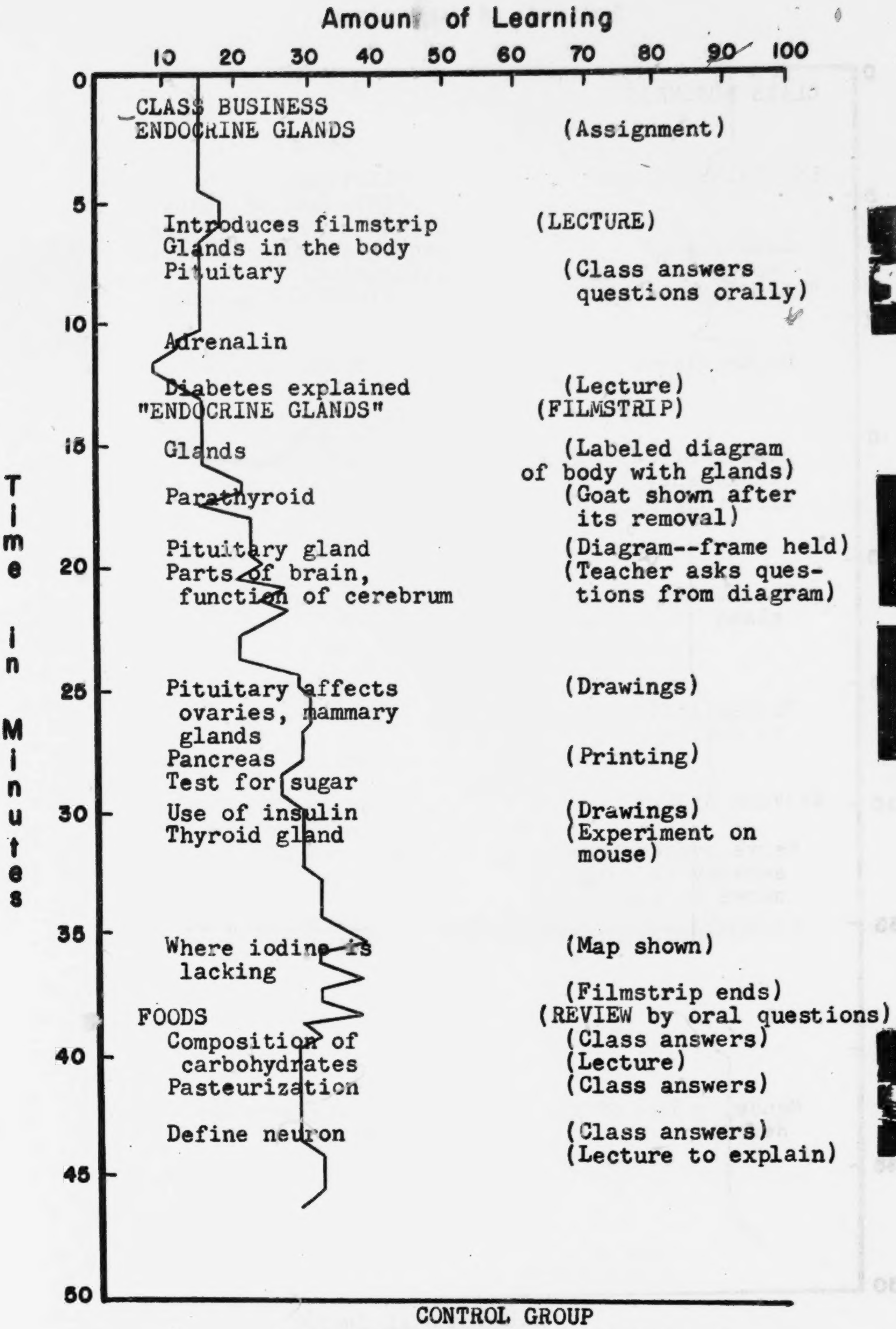
In both groups the test was prepared by the city schools.

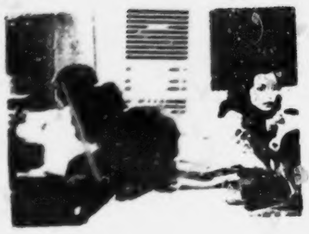
---

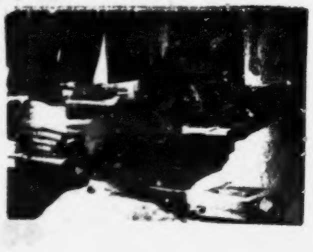
* "Functions of the Nervous System", Knowledge Builders Film Series, 1949. Black and white, 11 minutes.

** "Brain", Transparency 101--8, Visual Research Institute, 1960. 10" x 10" overlay. 2 colors.

"The Nervous System", Transparency 101--6, Visual Research Institute, 1960. 10" x 10" overlay, 4 colors.

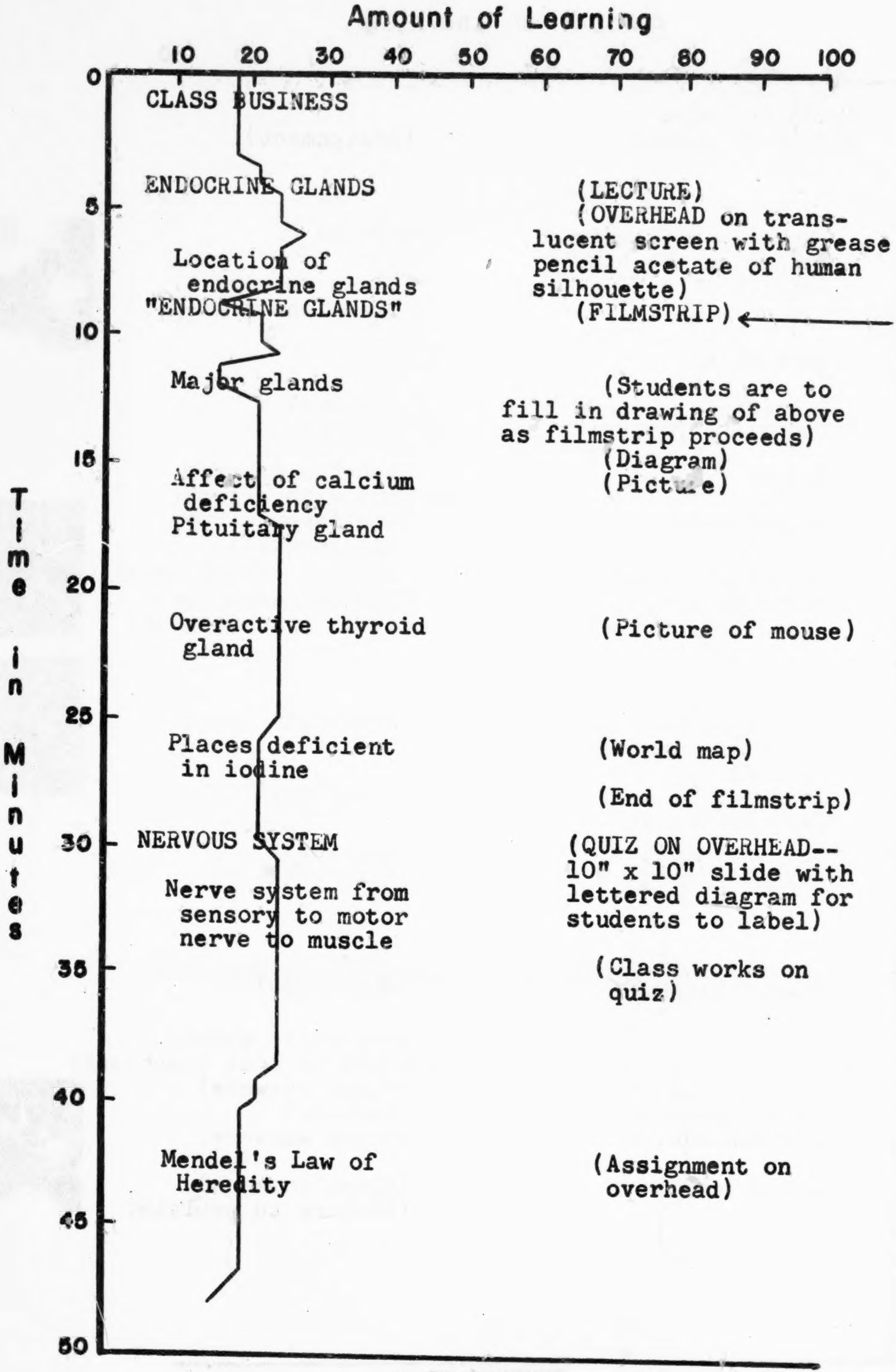






CONTROL GROUP

LEARNING PROFILE NUMBER 277



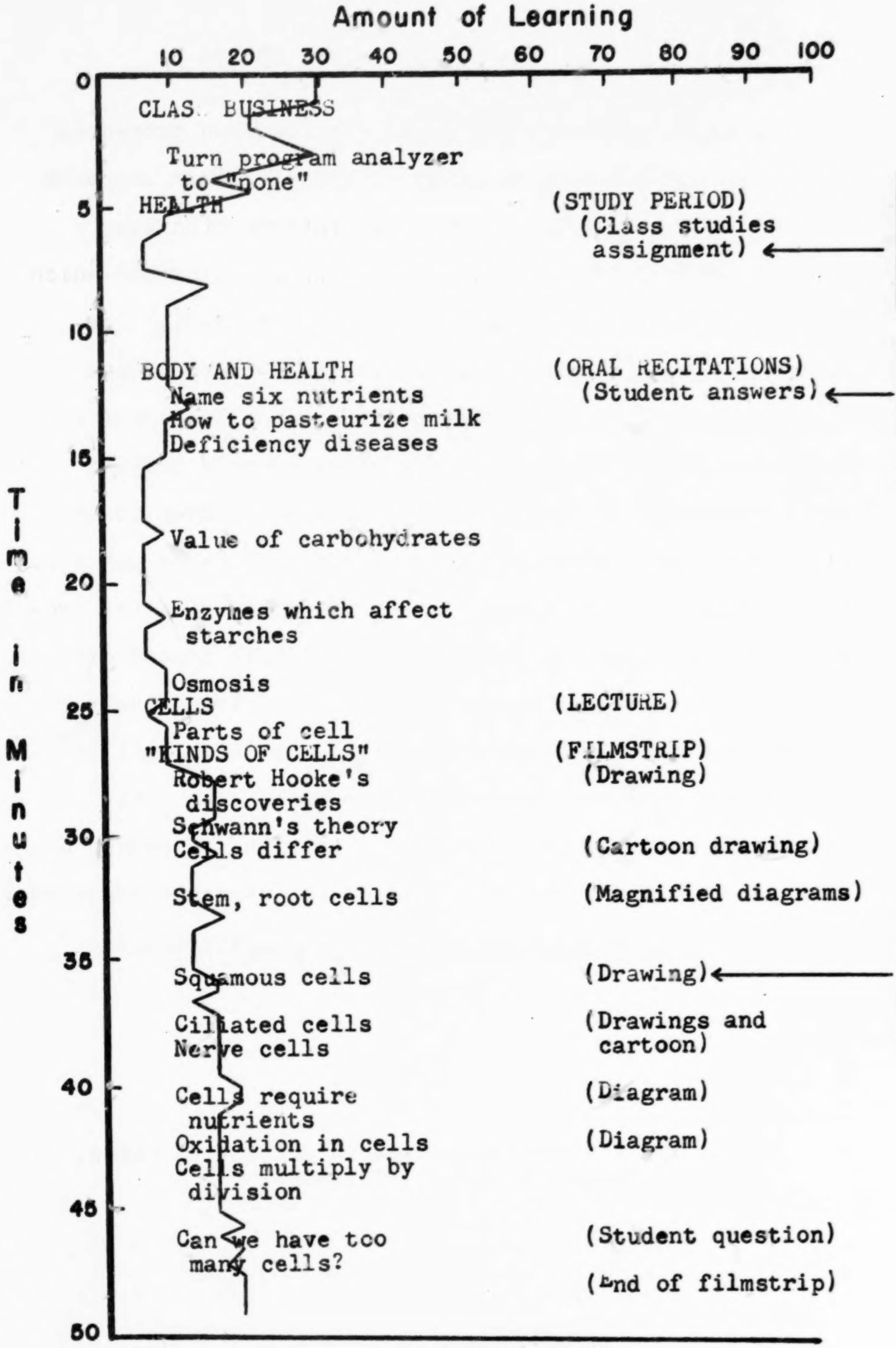
EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 278

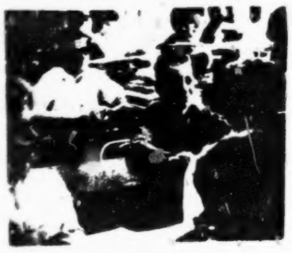
ANALYSIS OF LEARNING PROFILES 277 AND 278

An introduction to the class was low when presented by lecture in the Control Group (C 277, 5-13) as compared to the Experimental Group where the introduction was made by referring to a previously drawn illustration which was projected on a rear-view screen (E 278, 5-8). The latter approach required less class time. Both groups saw the same filmstrip* which began at a higher level in the Experimental Group where the students were looking for information to be placed on a drawing related to the filmstrip. Both profiles in the second and third quarter when compared on the basis of the system by which the profiles were analyzed on the basis of relative scales developed for Control and Experimental classes respectively. In the Experimental Group the profile was relatively level because the students were engaged in working on their drawings related to the filmstrip. Learning increased d during the presentation of a quiz on the overhead projector.

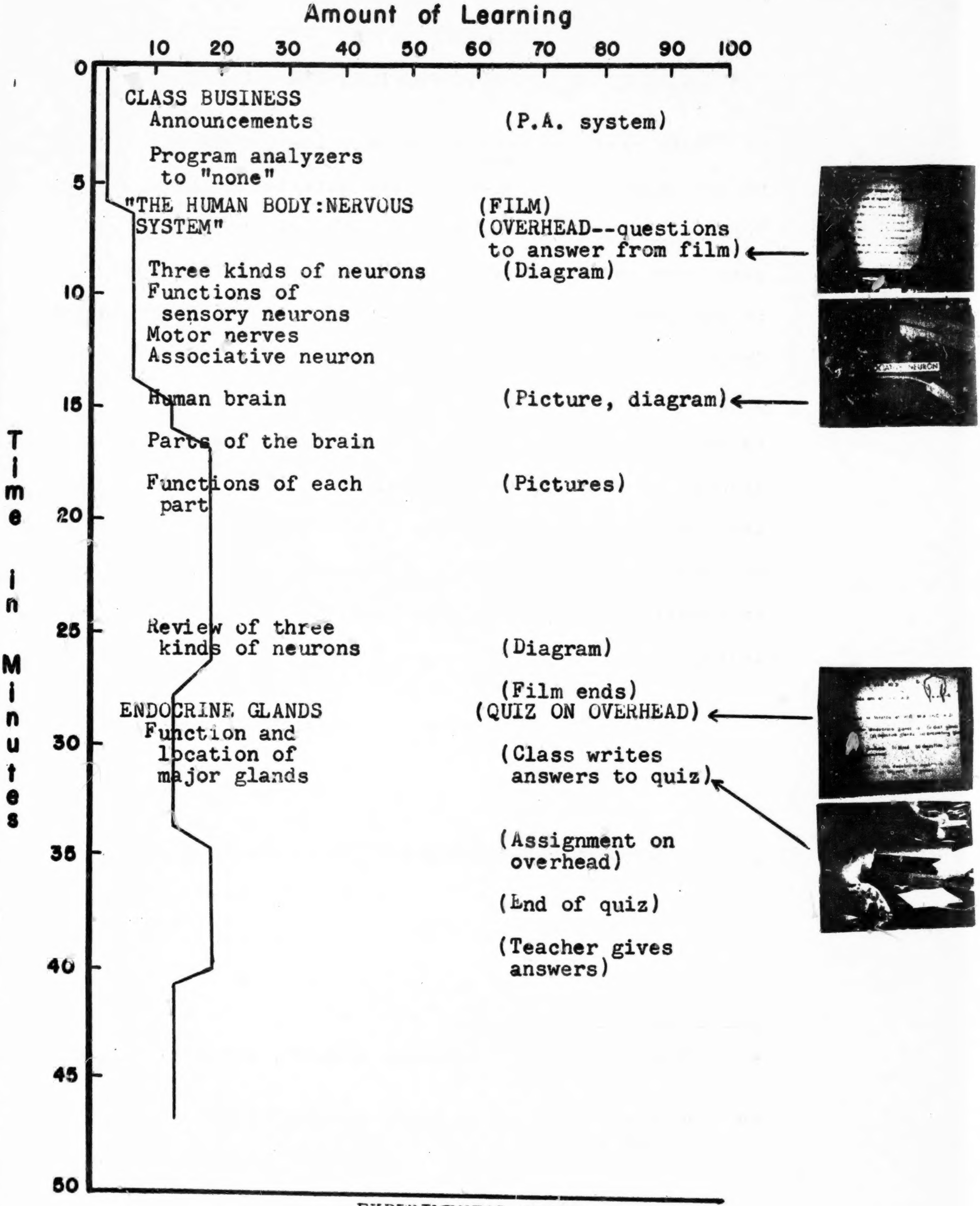
---

* "Endocrine Glands", Encyclopedia Britannica Films, 1950. Black and white, 70 frames.





CONTROL GROUP
LEARNING PROFILE NUMBER 279



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 280

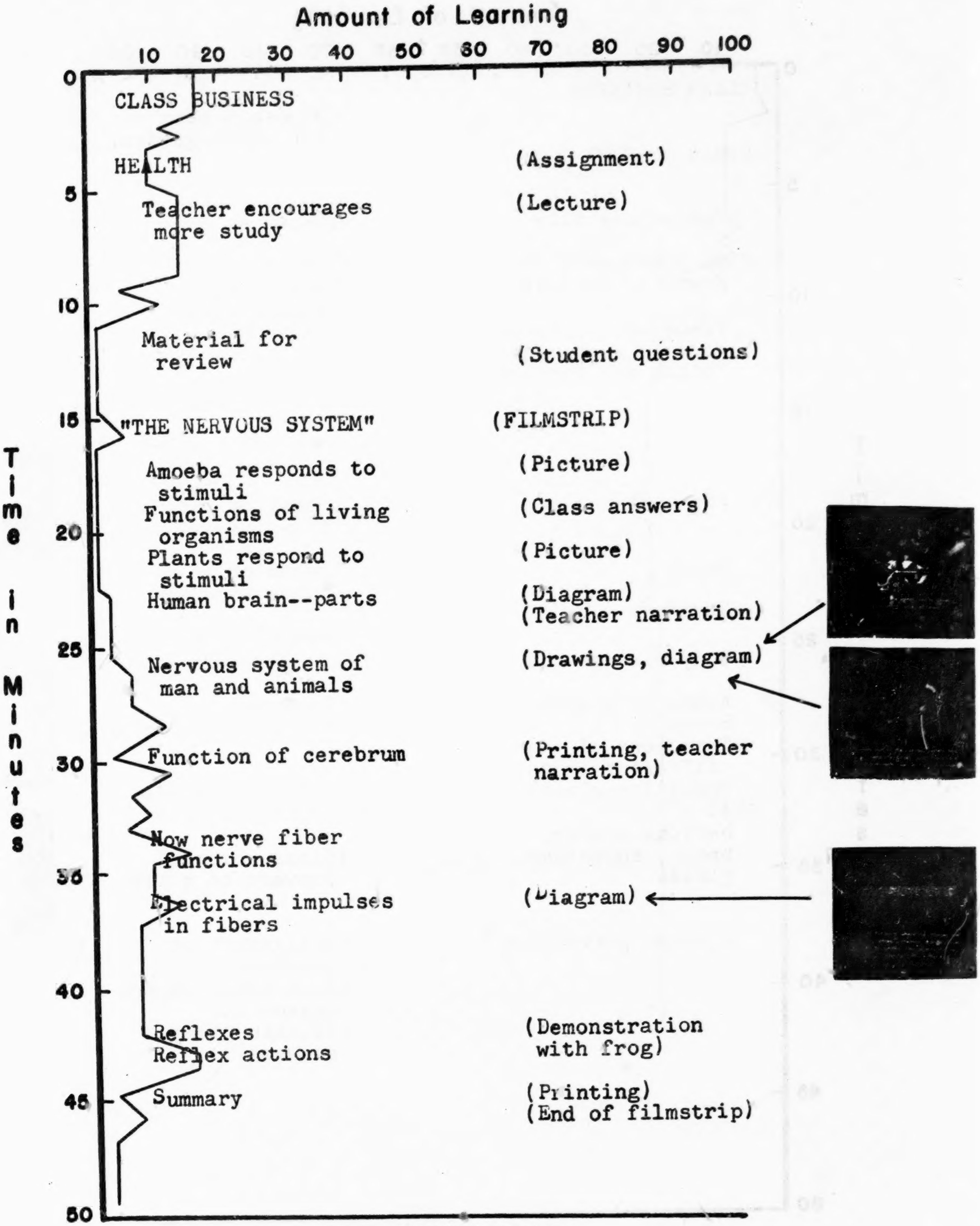
ANALYSIS OF LEARNING PROFILES 279 AND 280

Both profiles were relatively low unrelated to each other and provided review material. The film* (E 280, 6-28) resulted in approximately the same average percentage of learning as a filmstrip** in the Control Group (C 279, 27-48). In the Experimental Group a quiz on an overhead covering the material taken up in Experimental Group 278 resulted in a low level of learning during the film but learning increased when the answers to the quiz were given. This partially explains the reason why the filmstrip on the previous class did not result at a high level of learning. Apparently the information was difficult for any of the students to learn.

---

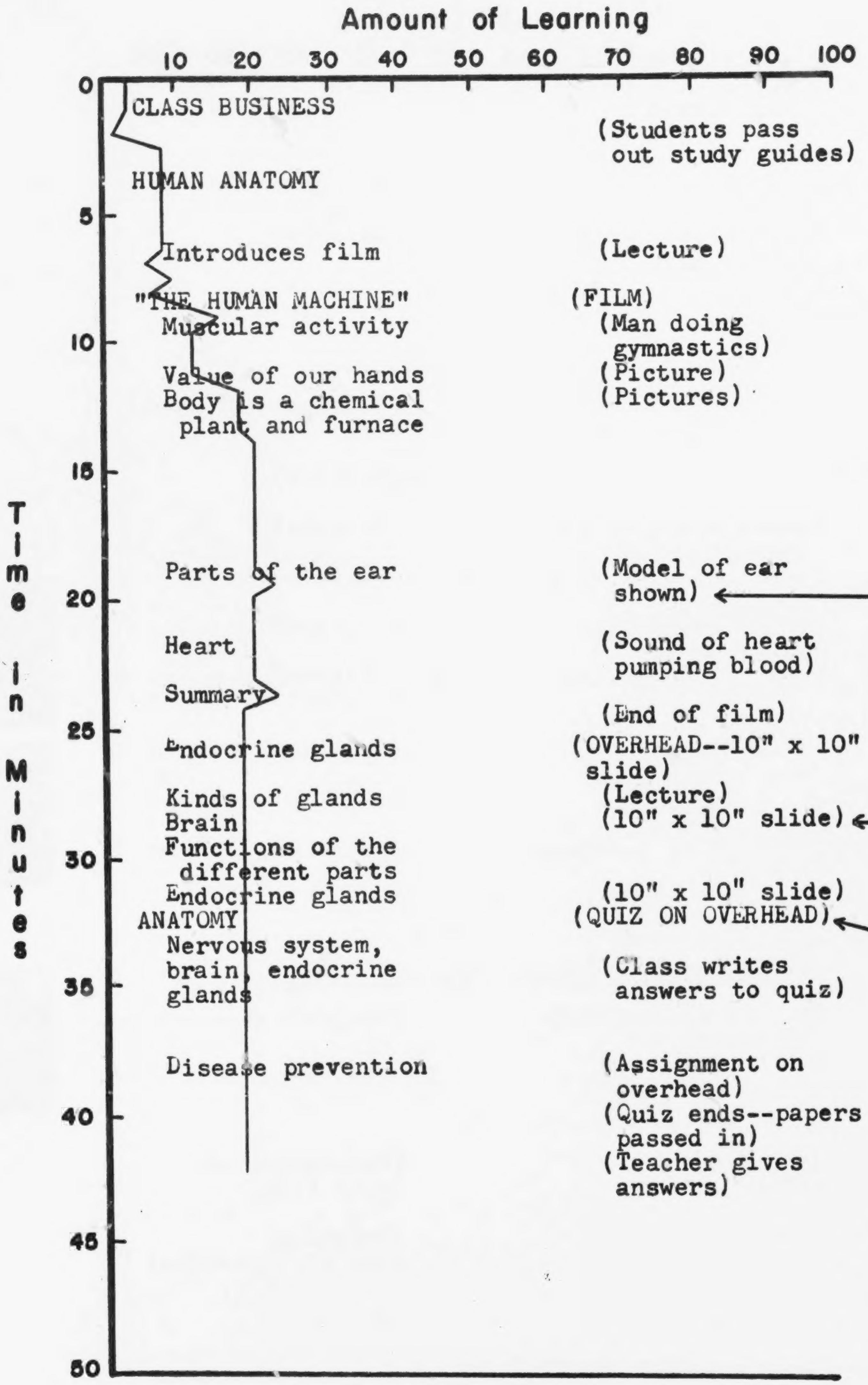
* "The Human Body: Nervous System", Coronet. Color 19 minutes.

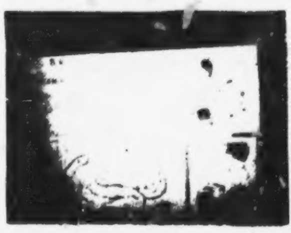
** "Kinds of Cells", Popular Science, 1952. Color 48 frames.



CONTROL GROUP

LEARNING PROFILE NUMBER 281





EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 282

ANALYSIS OF LEARNING PROFILES 281 AND 282

Information previously taken up resulted in a low level of learning in the Control Group even though a filmstrip* was utilized. With the greatest peaks of learning resulting at points where some slightly new information was presented (for instance C 281, 37) in the Experimental Group a higher level of learning resulted when a motion picture** was used and the level of learning was maintained by the use of an overhead transparency.***

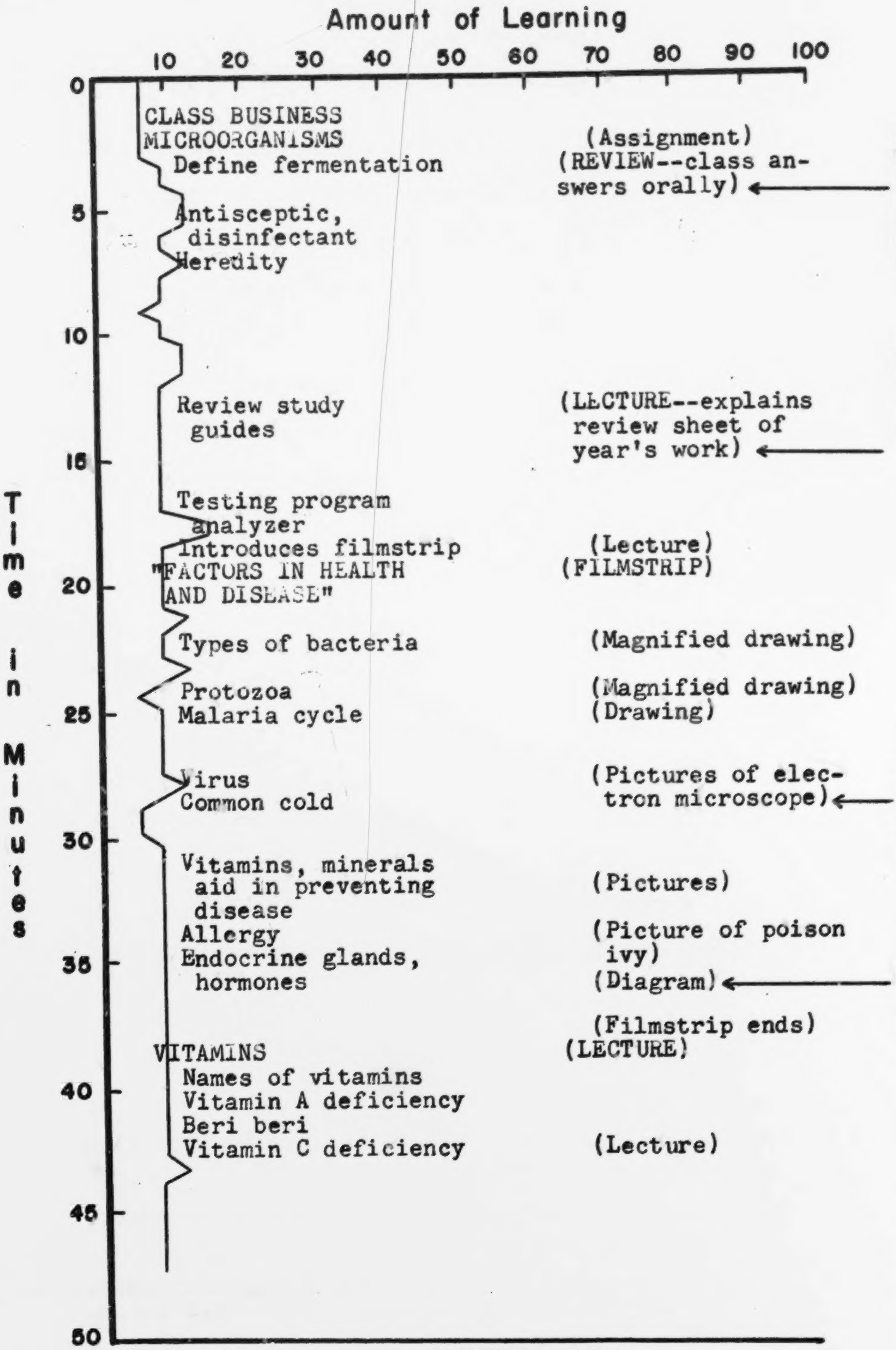
---

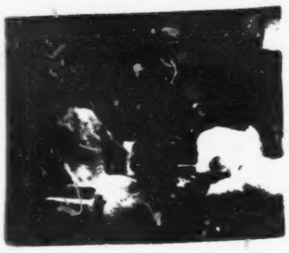
* "The Nervous System", Encyclopedia Britannica Film, 1950. Black and white, 66 frames.

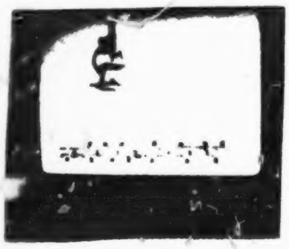
** "The Human Machine", Moody Institute of Science, 1950. Color, 14 minutes.

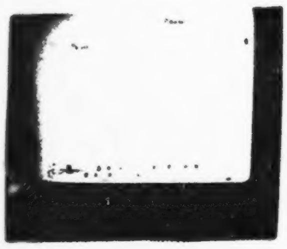
*** "Brain", Transparency 101-8, Visual Research Institute (Creative Visuals Company). 10 X 10, 2 colors red and black.

"Endocrine Glands", Transparency 101-7, Visual Research Institute (Creative Visuals Comapny). 10 X 10 2 colors, red and black.

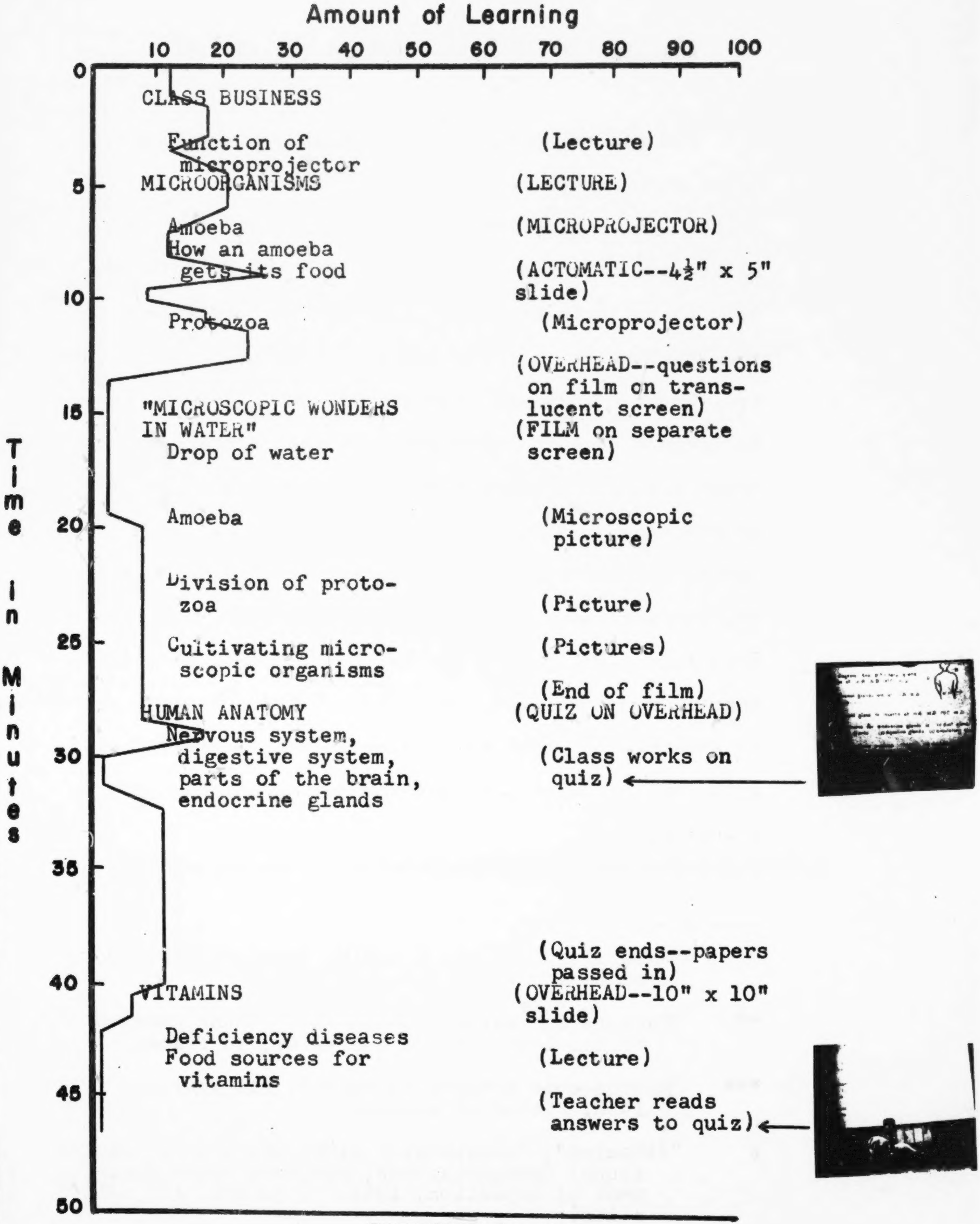








CONTROL GROUP
LEARNING PROFILE NUMBER 283



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 284

ANALYSIS OF LEARNING PROFILES 283 AND 284

The general topic of microorganisms was taken up in both groups. The highest peak of learning resulted in the Experimental Group where an actomatic slide was presented of an amoeba getting food (E 284, 9). Learning in the Control Group fell completely in the lower quarter of the range of profiles for the Control Group. This was true whether the presentation was by lecture or by filmstrip**. In the Experimental Group a motion picture film*** resulted in a low level of learning in spite of the fact that it was accompanied by questions on the overhead projected on a rear-view screen to guide students study of the film. This film also fell in the lower quarter of the Experimental Group profiles. An overhead transparency# resulted in a detree of learning because it was used very briefly(E 284, 41) with the teaching moving quickly into a lecture.

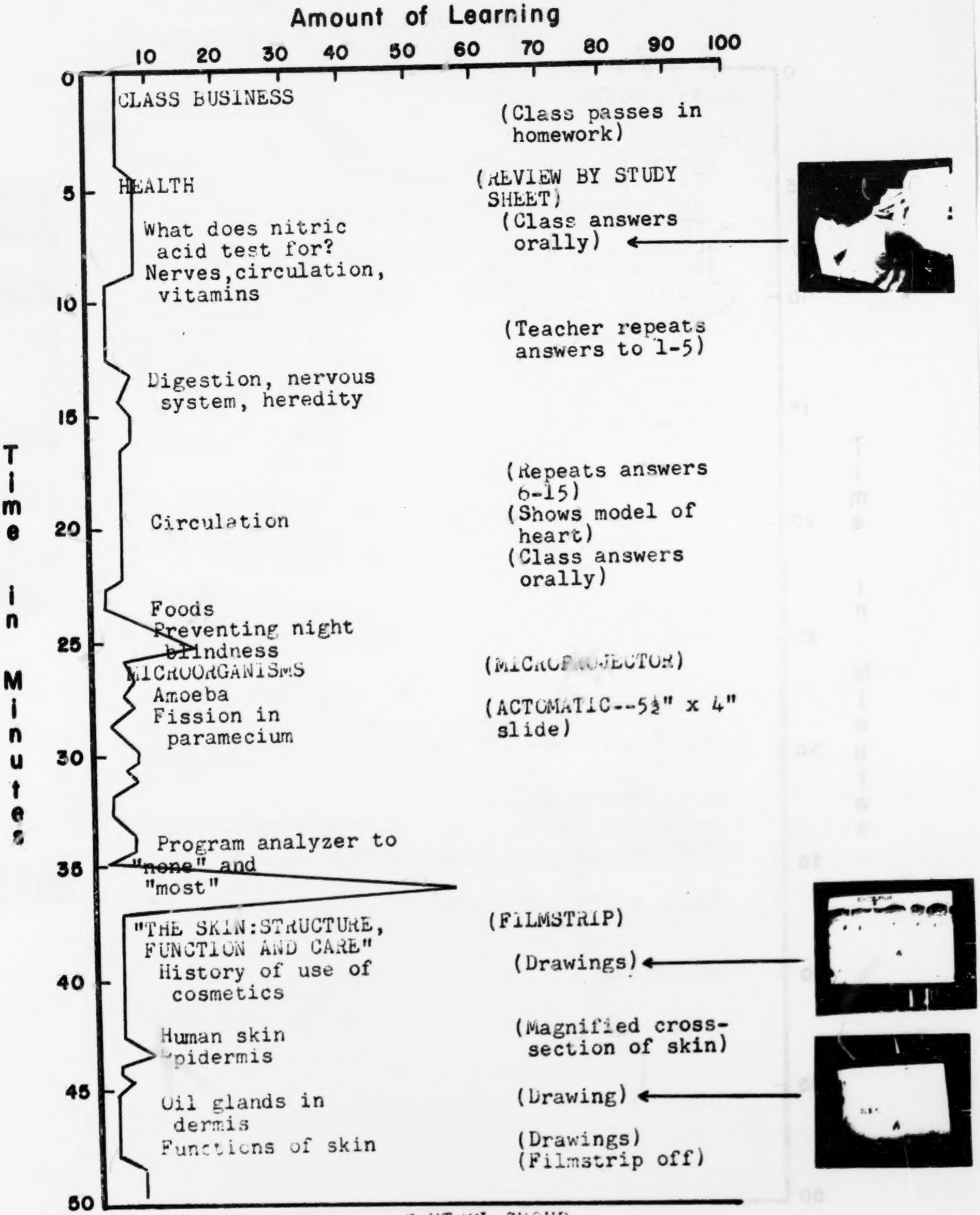
---

* "Amoeba", Slide no. B 4-010, Instructolab, 1960. Black and white, 4" x 5" slide.

** "Factors in Health and Disease", Young America Films, 1955. Black and white, 38 frames.

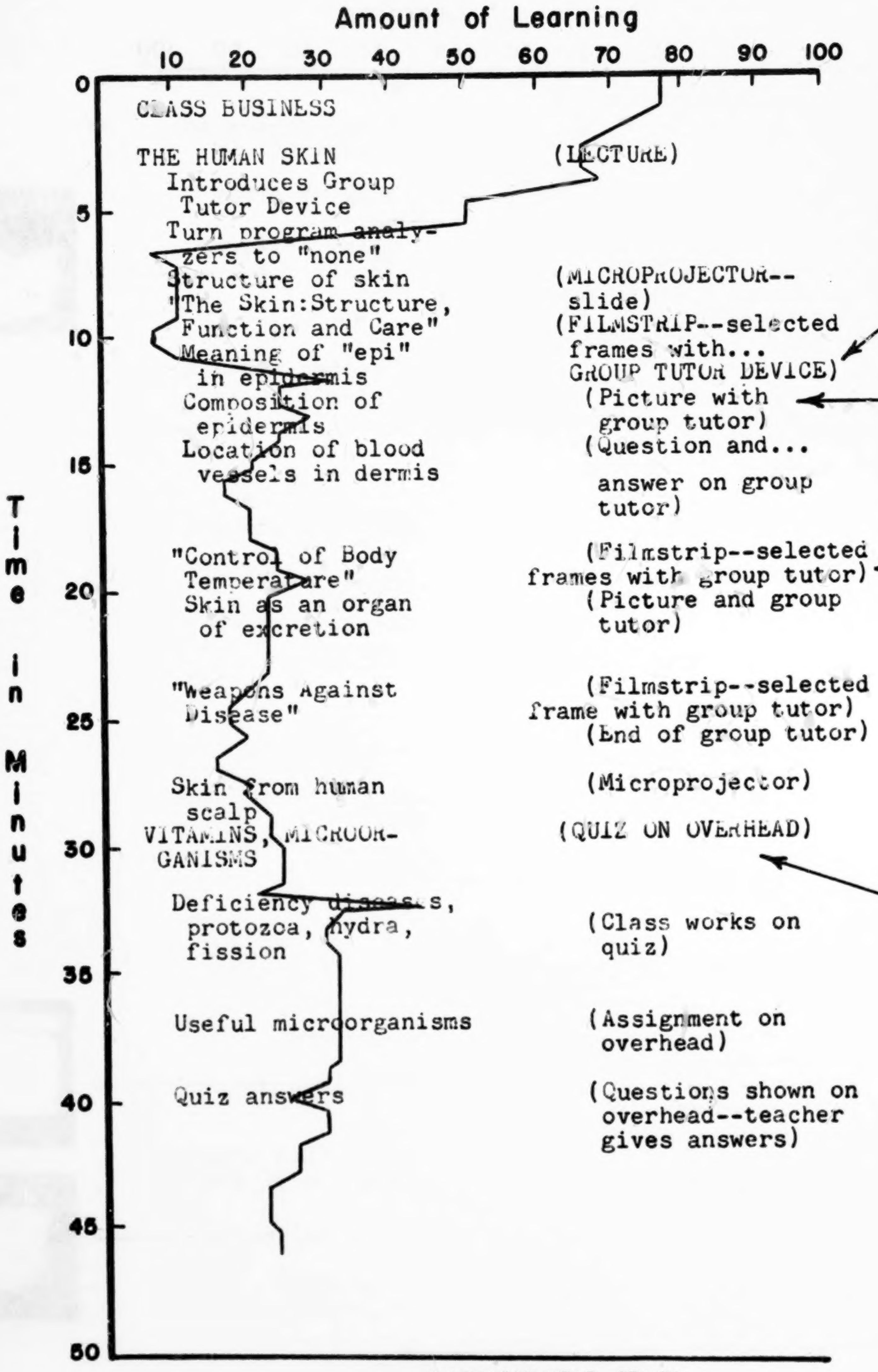
*** "Microscopic Wonders in Water", Pat Dowling, 1958. Color,12 minutes.

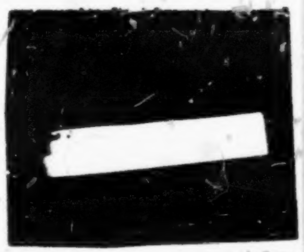
# "Vitamins", Transparency XIDD, Division of Educational Communications, New York State Department of Education, 1961. 4 colors, 10" x 10" slide.

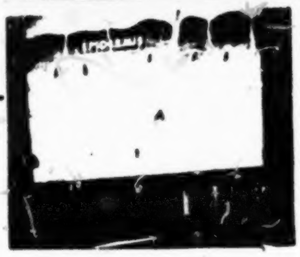


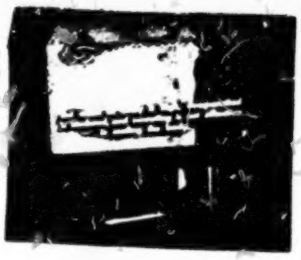
CONTROL GROUP

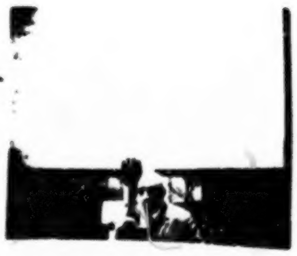
LEARNING PROFILE NUMBER 285











EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 286

ANALYSIS OF LEARNING PROFILES 285 AND 286

The level of learning was so very low during the Control Group that the presentation was changed from the use of a filmstrip* to a multi-media approach in which the subject was presented by means of a microscopic slide of a cross section of skin followed by selected frames from the same filmstrip** accompanied by questions and answers presented on the group tutor device utilizing the overhead projector. Also, select films from another filmstrip*** were utilized. Also appropriated for the topic were selected frames from yet another filmstrip#. Presentation was summarized with a high level of learning resulting by showing skin from a human scalp from the micro-projector. Learning was also high in the Experimental Group when a quiz on the subject matter of the previous class day was taken out.

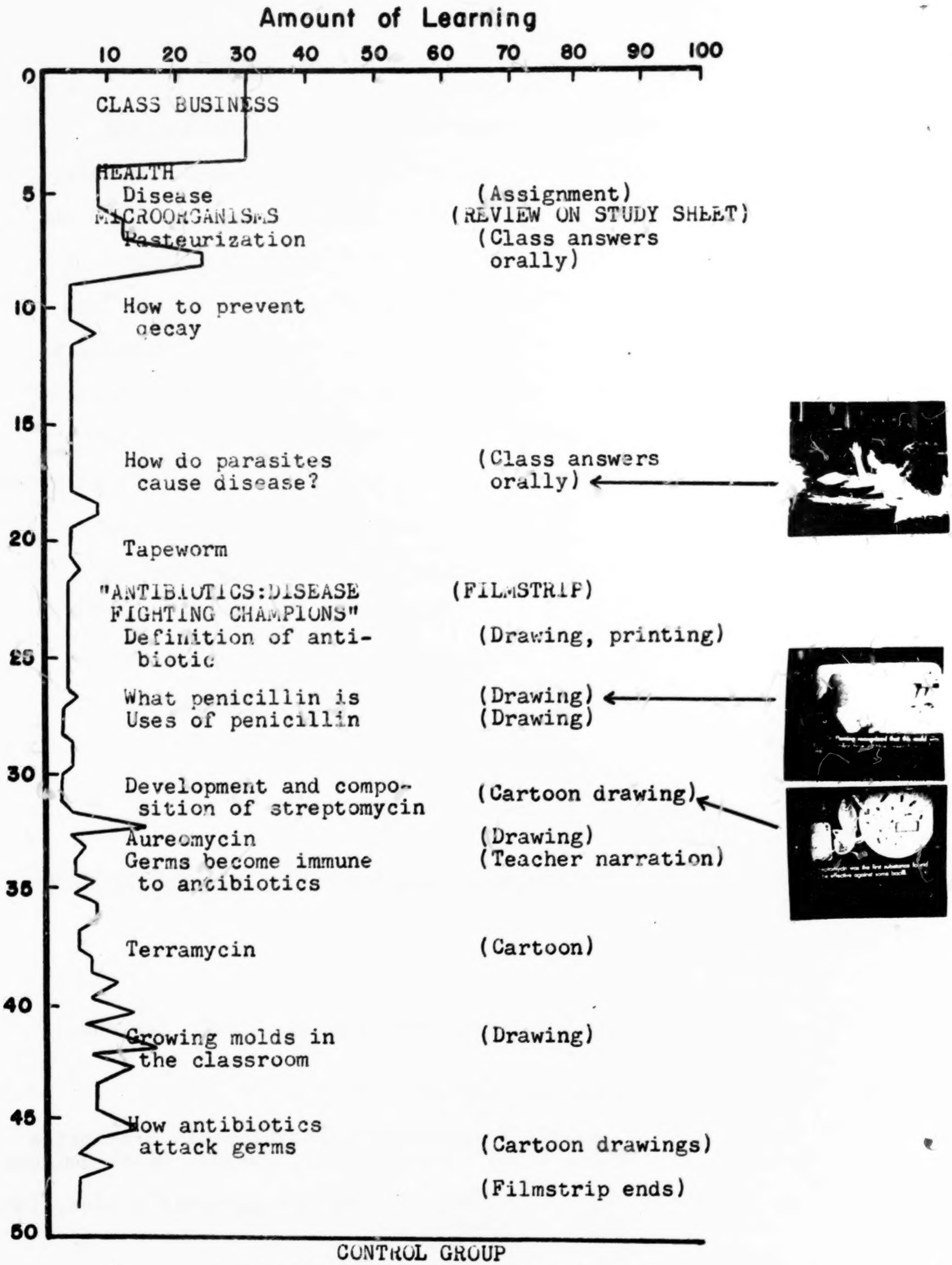
---

* "The Skin: Structure, Function and Care", Jergens, Color.

** Ibid. Frames 11, 15, 17

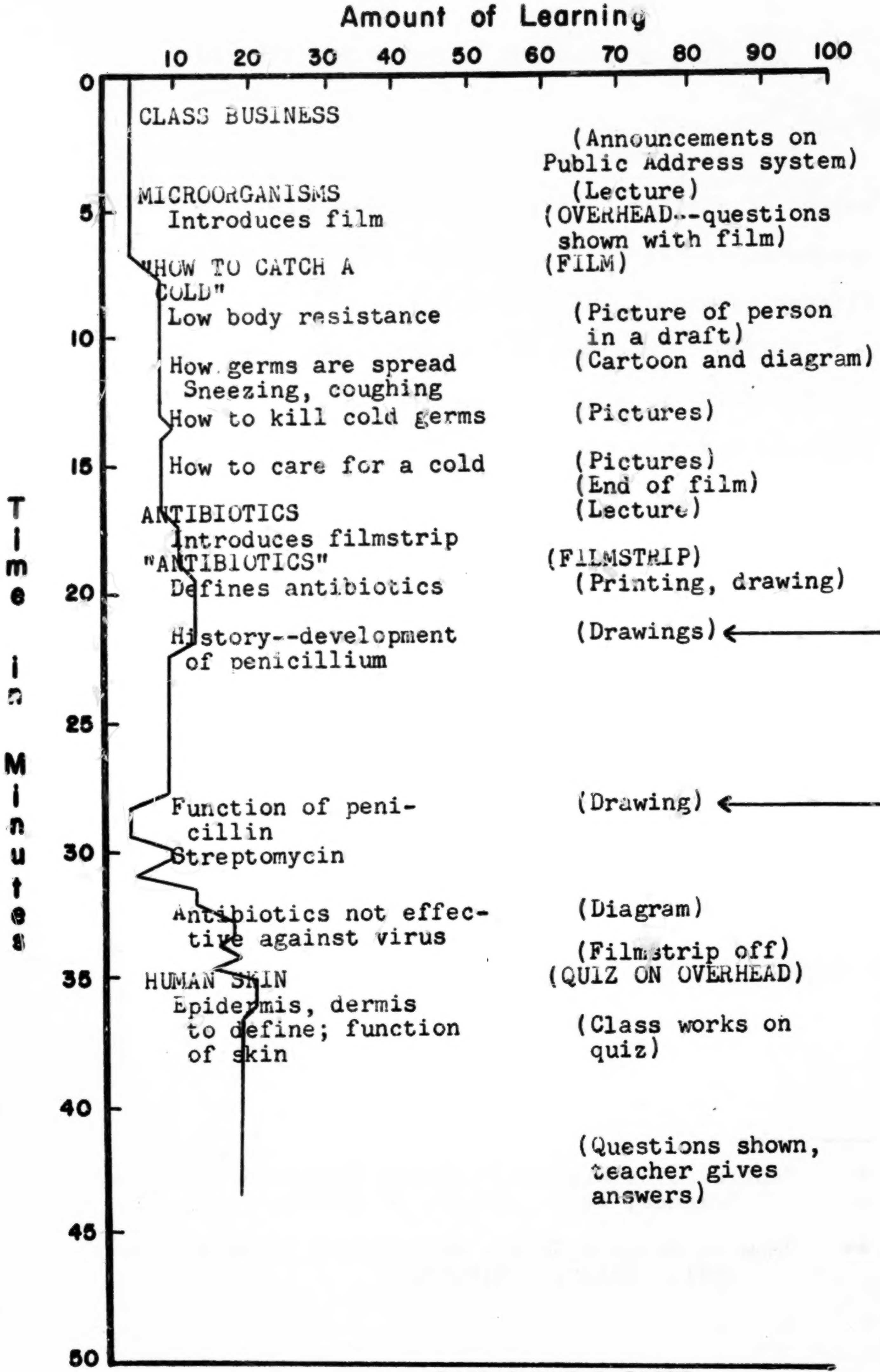
*** "Control of Body Temperature", Encyclopedia Britannica Films, 1950. Frames 29-31, 36-38. Black and white.

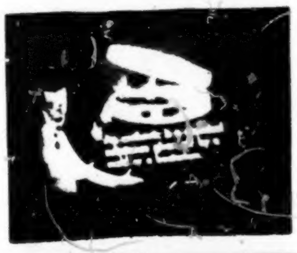
# "Weapons Against Disease," Charles Scribner's Sons, 1957. Color. Frames 4,5,6.

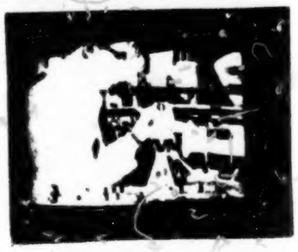


CONTROL GROUP

LEARNING PROFILE NUMBER 287







EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 288

ANALYSIS OF LEARNING PROFILES 287 AND 288

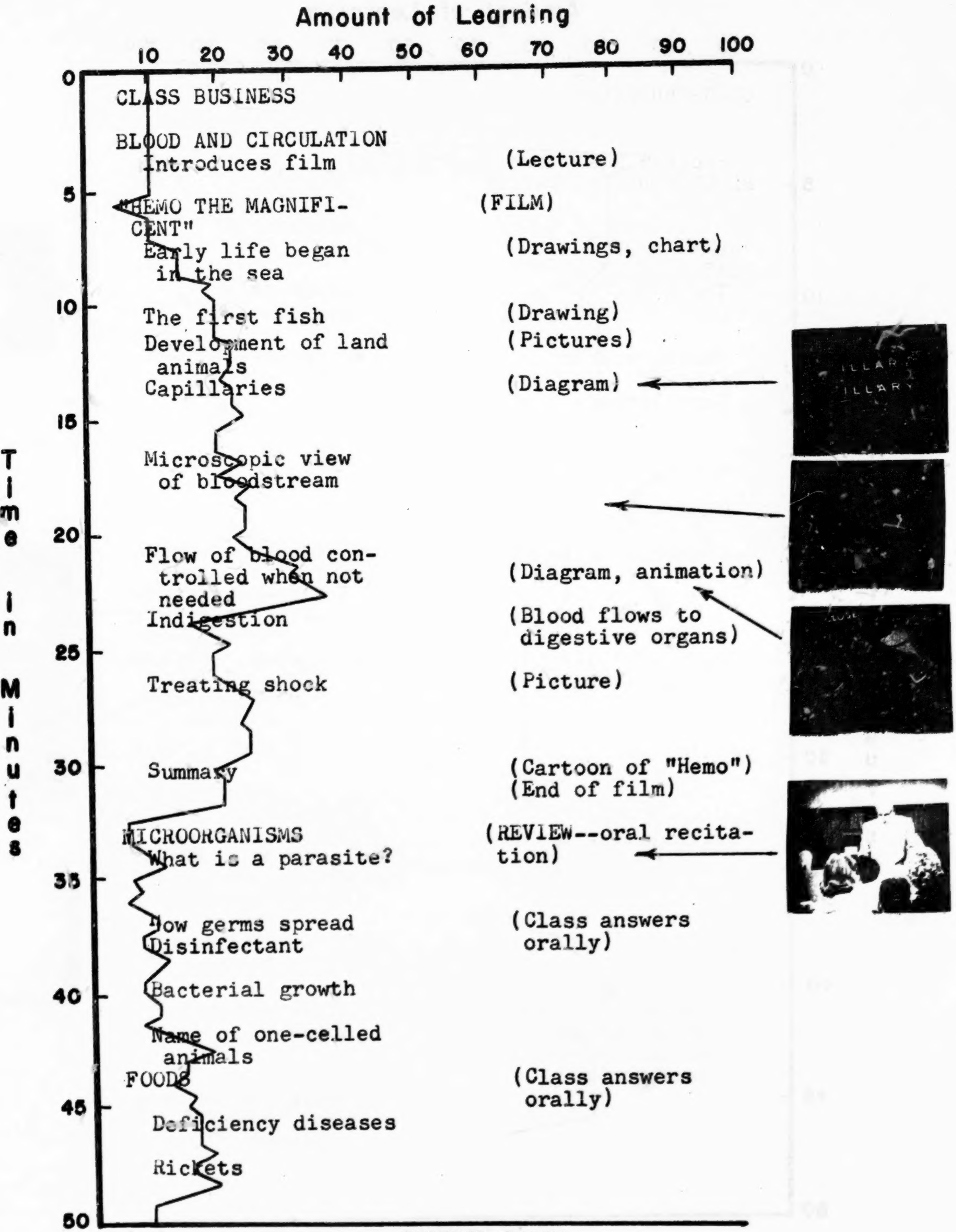
The use of the same filmstrip* in both groups resulted in similarly low profiles in both groups whether presented in twenty-five minutes (C 287, 23-48) or in fifteen minutes (E 288, 19-34).

A film** resulted in no significant learning (E 288, 8-15) because the content was not new, the students had seen the film before.

---

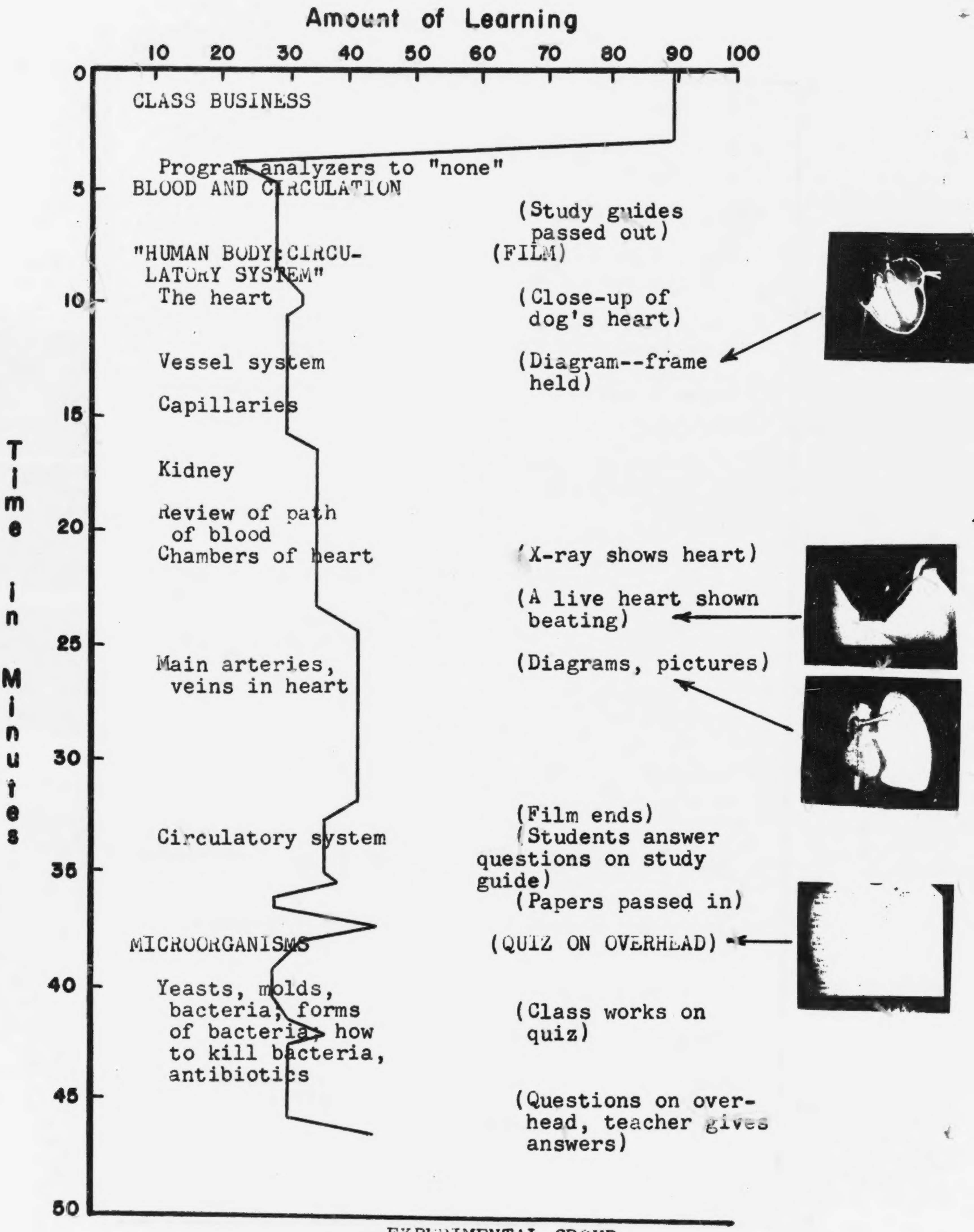
* "Antibiotics:Disease Fighting Champions", Popular Science, 1957. Color, 32 frames.

** "How to Catch a Cold", Walt Disney (Kleenex Co.), 1951. Color, 7 minutes.



CONTROL GROUP

LEARNING PROFILE NUMBER 289



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 290

ANALYSIS OF LEARNING PROFILES 289 AND 290

A motion picture[*] originally prepared for presentation to other types of audiences did not result in as high an average level of learning as one which was prepared specifically as an instructional film.[**] The range of profile heights for both Experimental and Control Groups was divided into quarters. In the Control Group the film fell, for the most part, in the 2nd quarter. The film in the Experimental Group, however fell predominately in the 3rd and 4th quarters.

Leraning was higher in the Experimental Group during a quiz than in the Experimental Group during a review by oral recitation.

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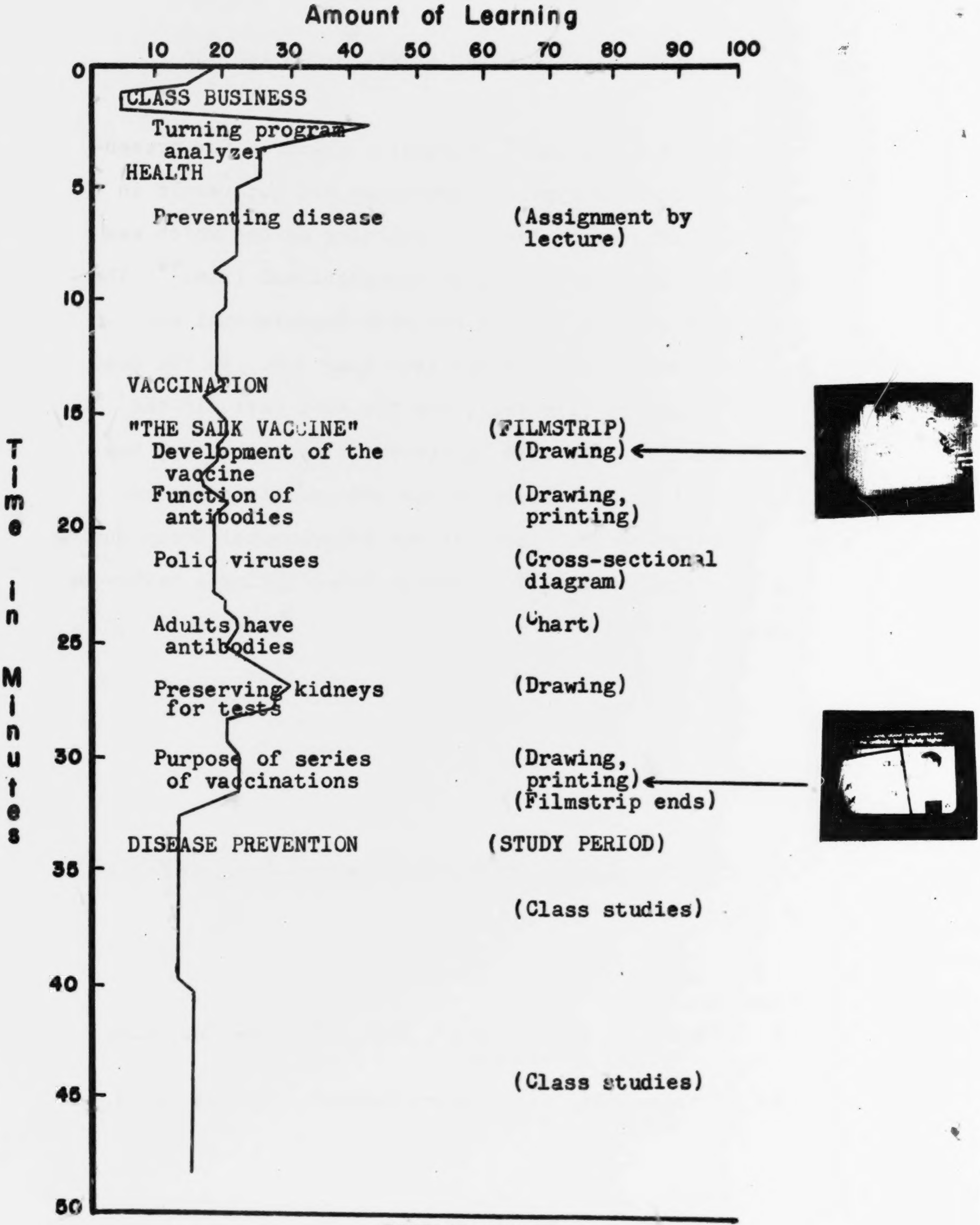
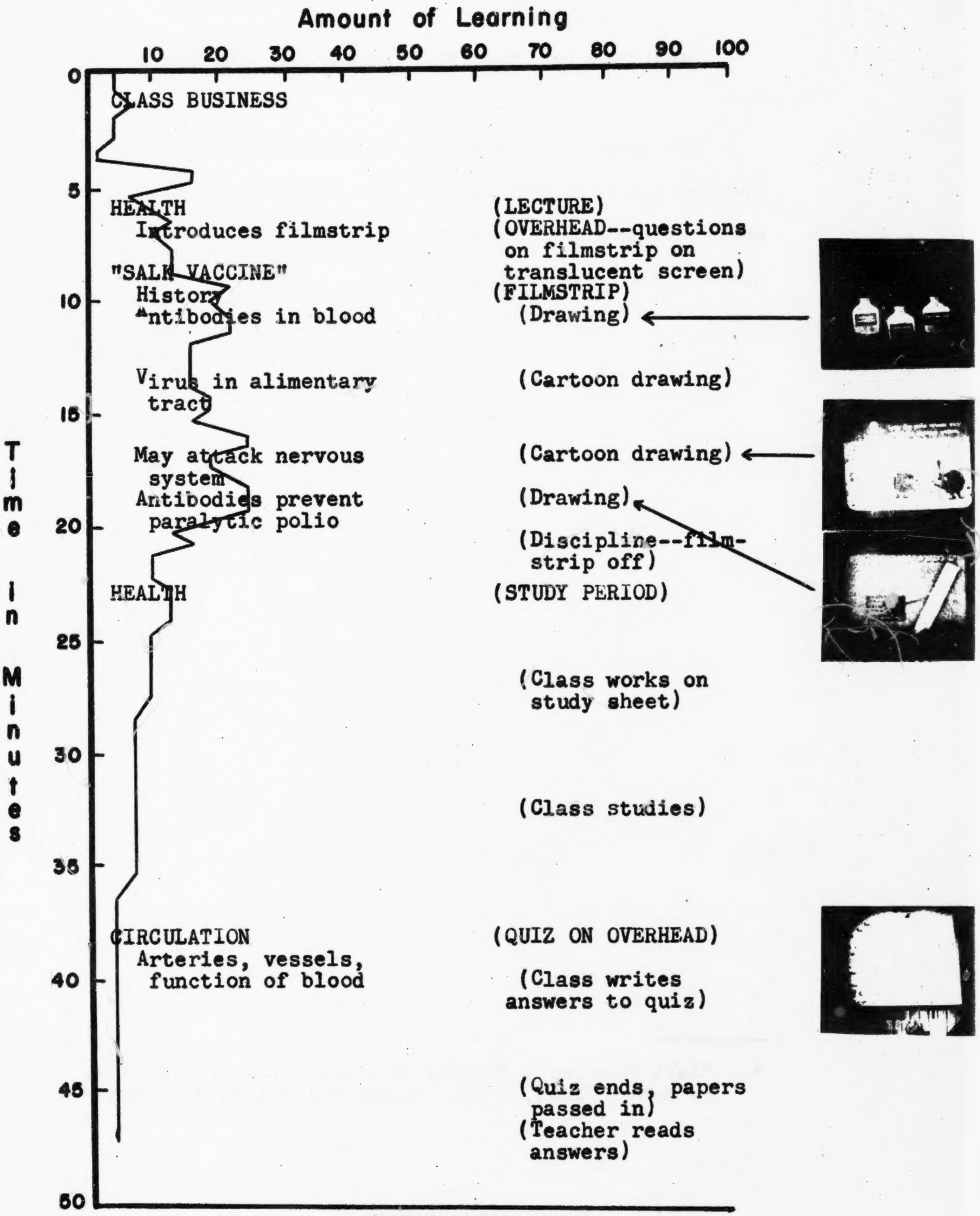
[*] "Hemo the Magnificant", Bell Telephone Co., n.d. Color, 11 minutes.

[**] "Human Body: Circulatory System", Coronet, 1958. Color, 13.5 minutes.



CONTROL GROUP

LEARNING PROFILE NUMBER 291



EXPERIMENTAL GROUP

LEARNING PROFILE NUMBER 292

ANALYSIS OF LEARNING PROFILES 291 AND 292

The same filmstrip* was utilized in both groups. Greater learning resulted in the Experimental Group where questions to fuide study of the filmstrip were projected on a rear-view screen.

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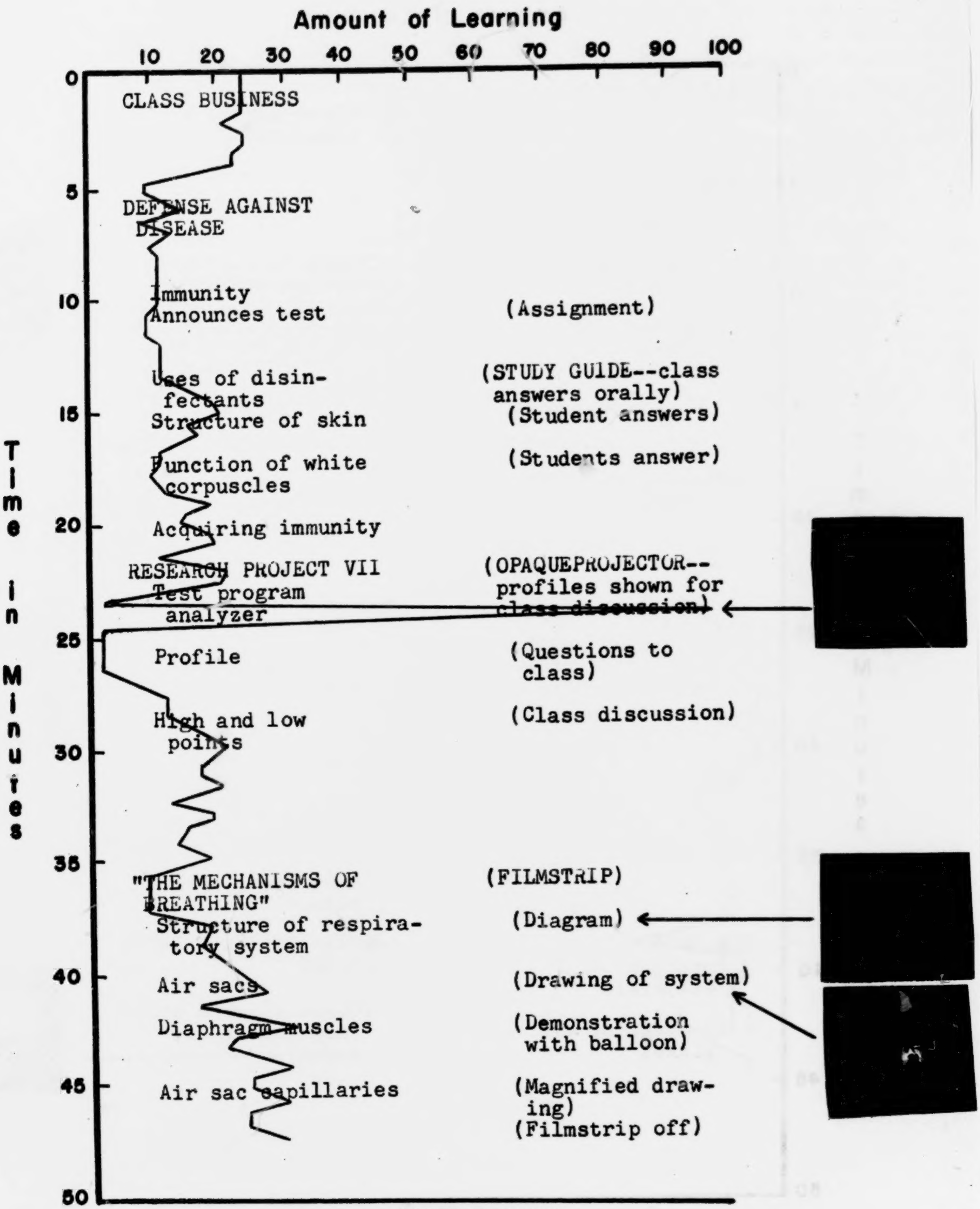
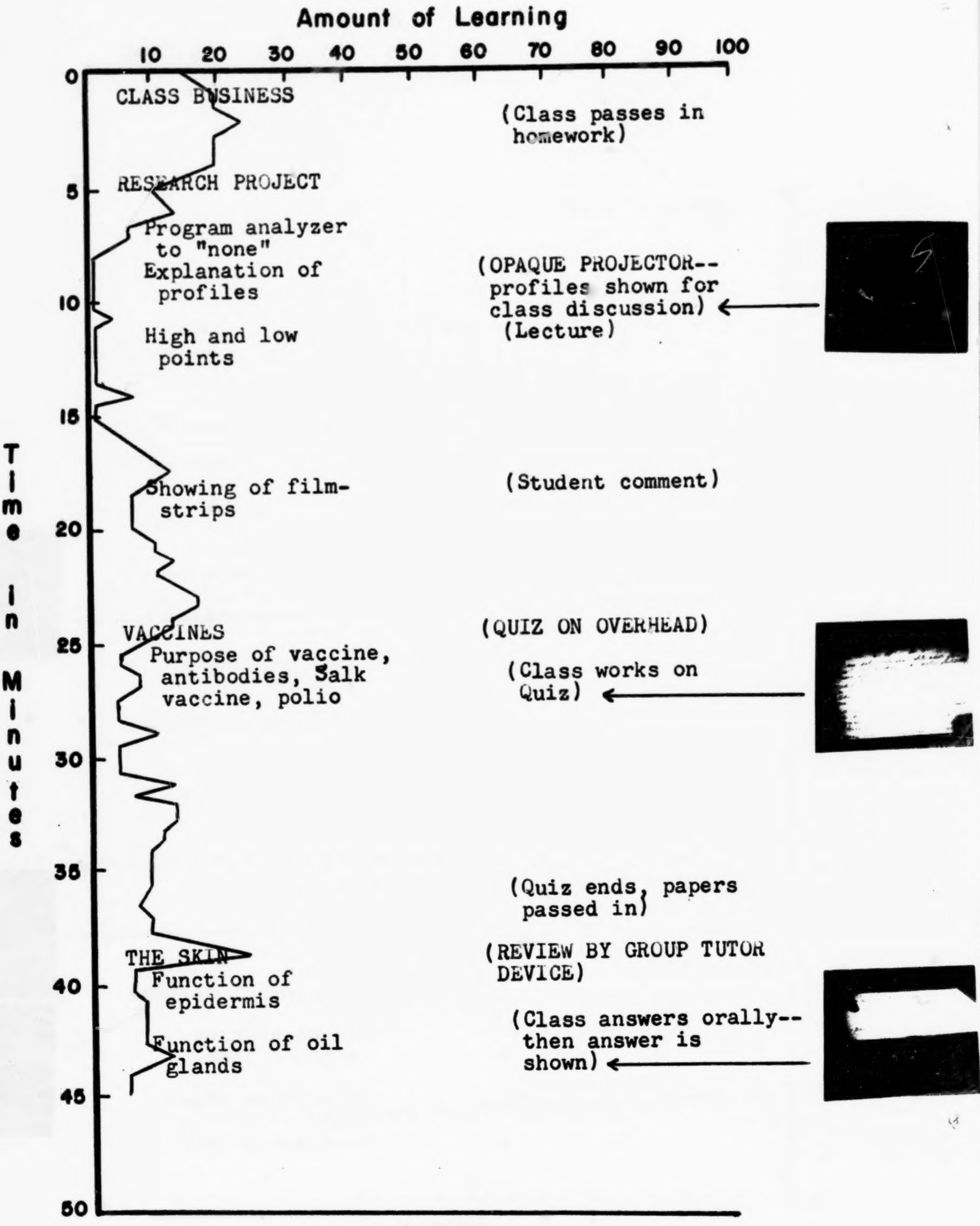
* "Salk Vaccine", Popular Science (Filmstrip of the Month Club), 1955. Black and white, 39 frames.



CONTROL GROUP

LEARNING PROFILE NUMBER 293



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 294

ANALYSIS OF LEARNING PROFILES 293 AND 294

Learning about the function of the skin in immunity, was greater in the Control Group (C 293, 13-20) where the information was new as compared to the Experimental Group where (E 294, 38-44) the material was so well covered in previous classes that no new information was presented even though the means used was the Group Tutor Device.

Learning reached some peaks during the use of a filmstrip[*] in the Control Group (C 293, 37-48). The filmstrip was not used in the Experimental Group because breathing was taken up in a previous unit.

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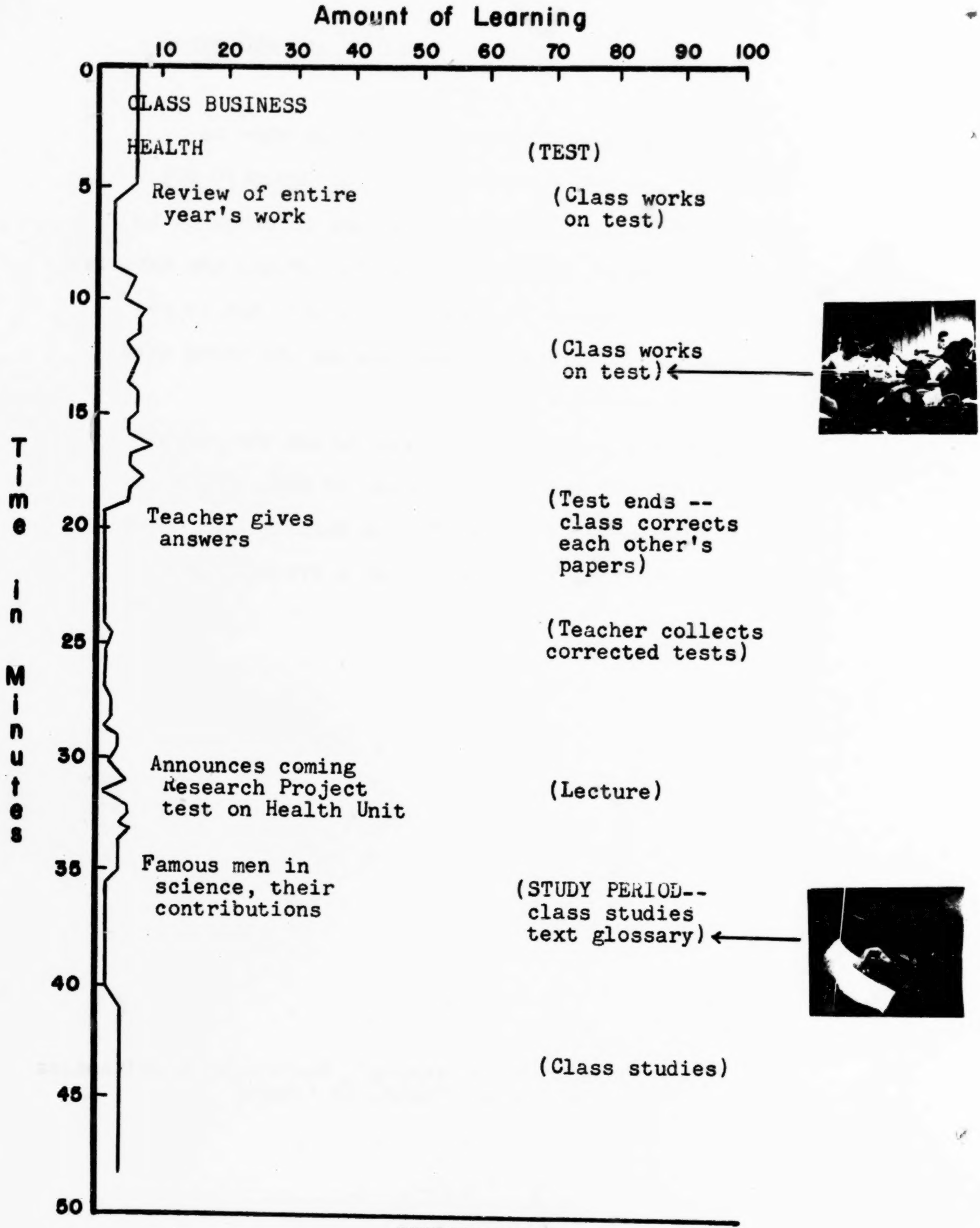
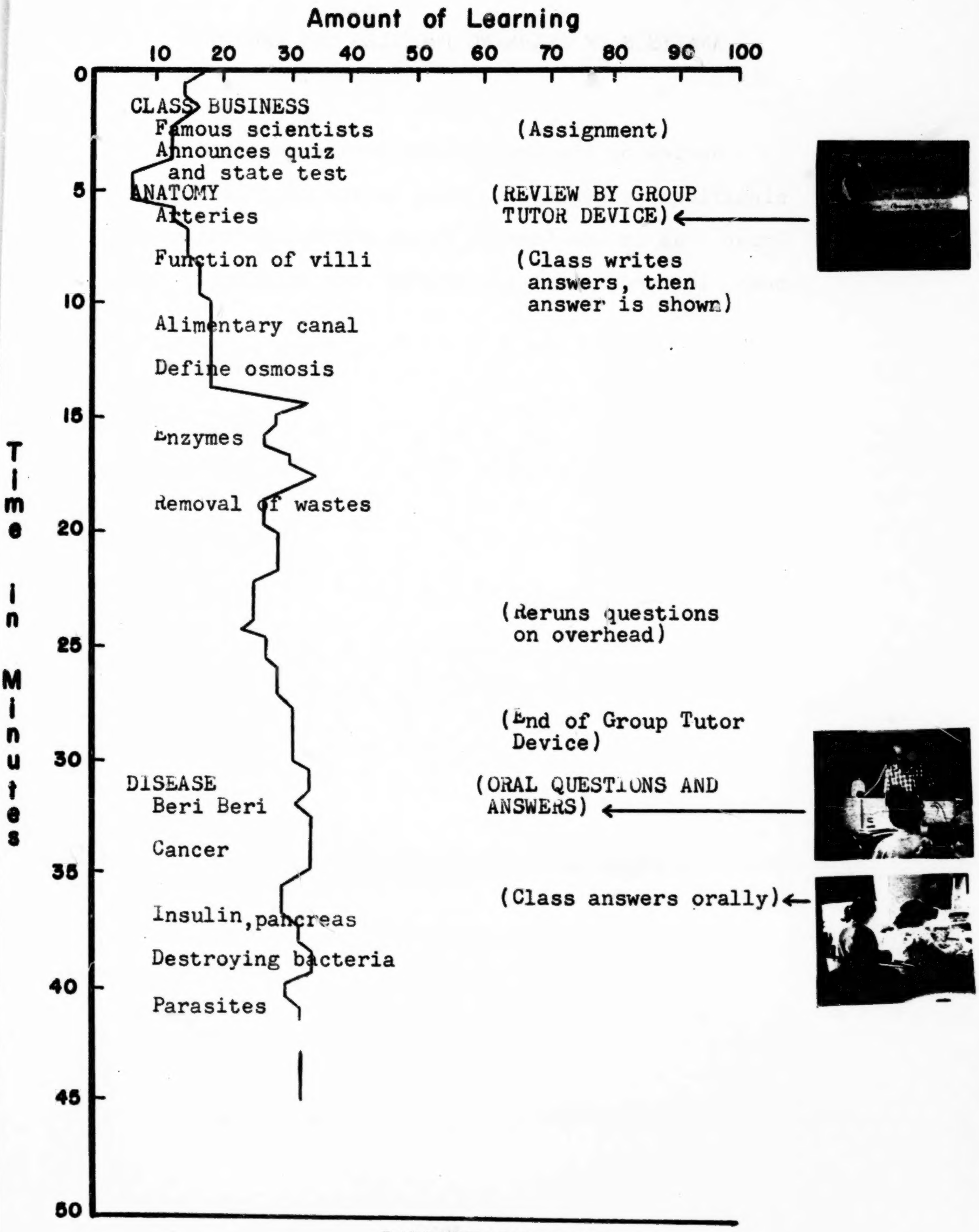
[*] "The Mechanisms of Breathing", Encyclopedia Britannica Filmstrip, 1950. Color, 39 frames.



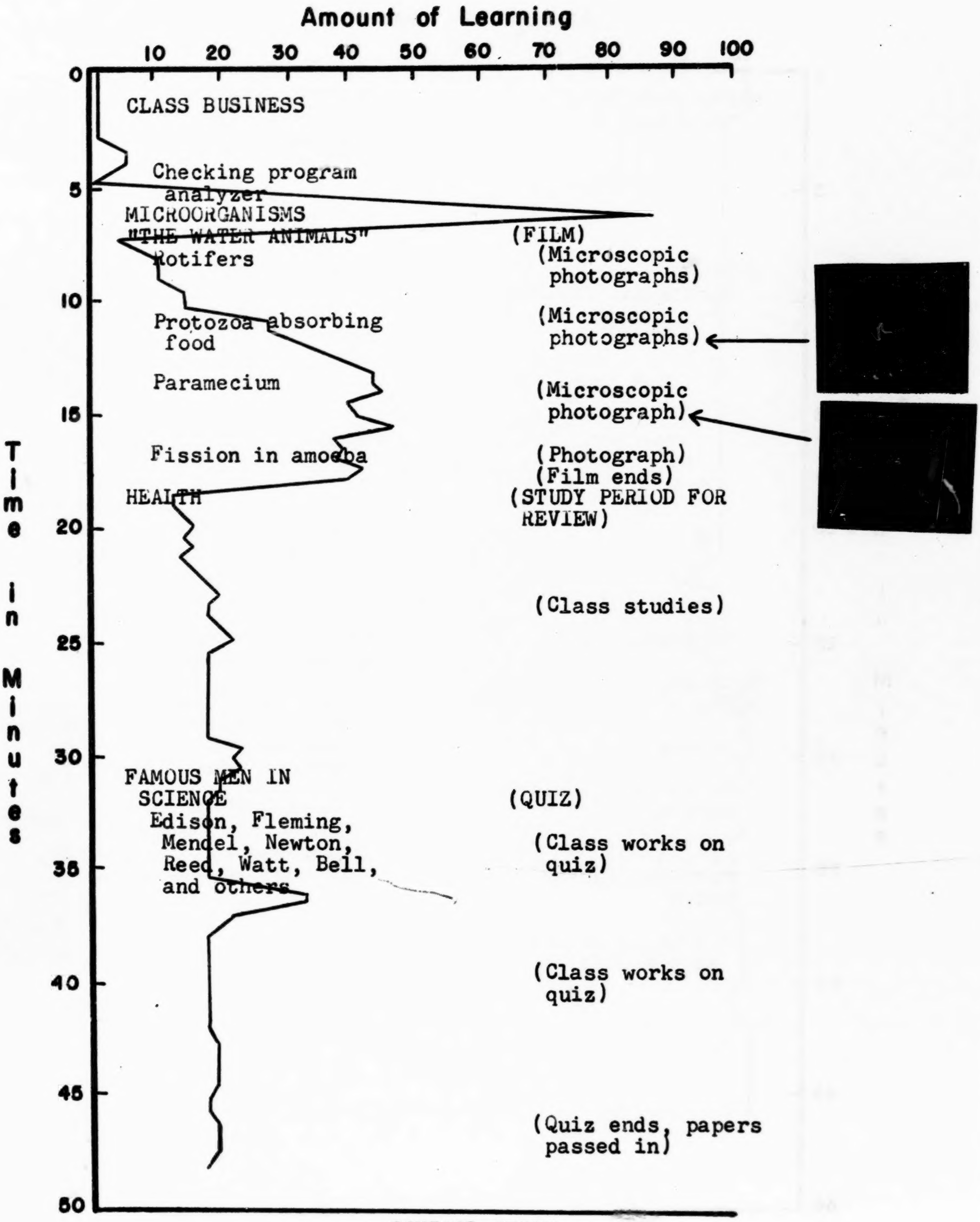
CONTROL GROUP
LEARNING PROFILE NUMBER 295



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 296

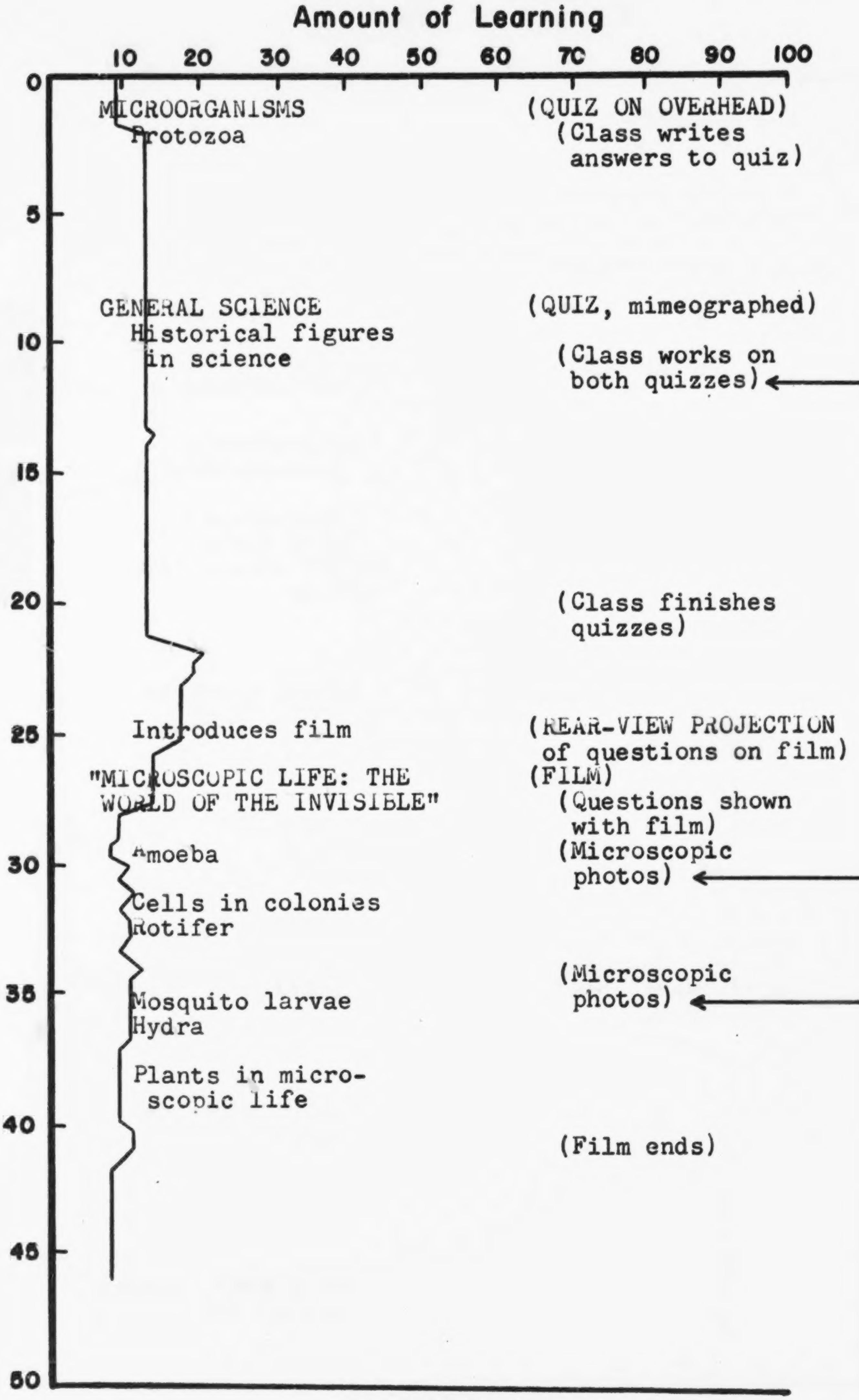
ANALYSIS OF LEARNING PROFILES 295 AND 296

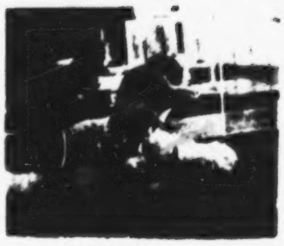
Review by the Group Tutor Device resulted in significantly higher learning in the Experimental Group than in the Control Group where a standard test, lecture, and study period were utilized.

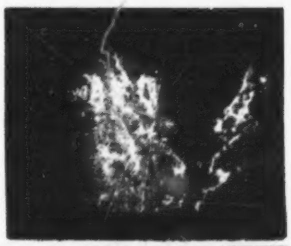


CONTROL GROUP

LEARNING PROFILE NUMBER 297

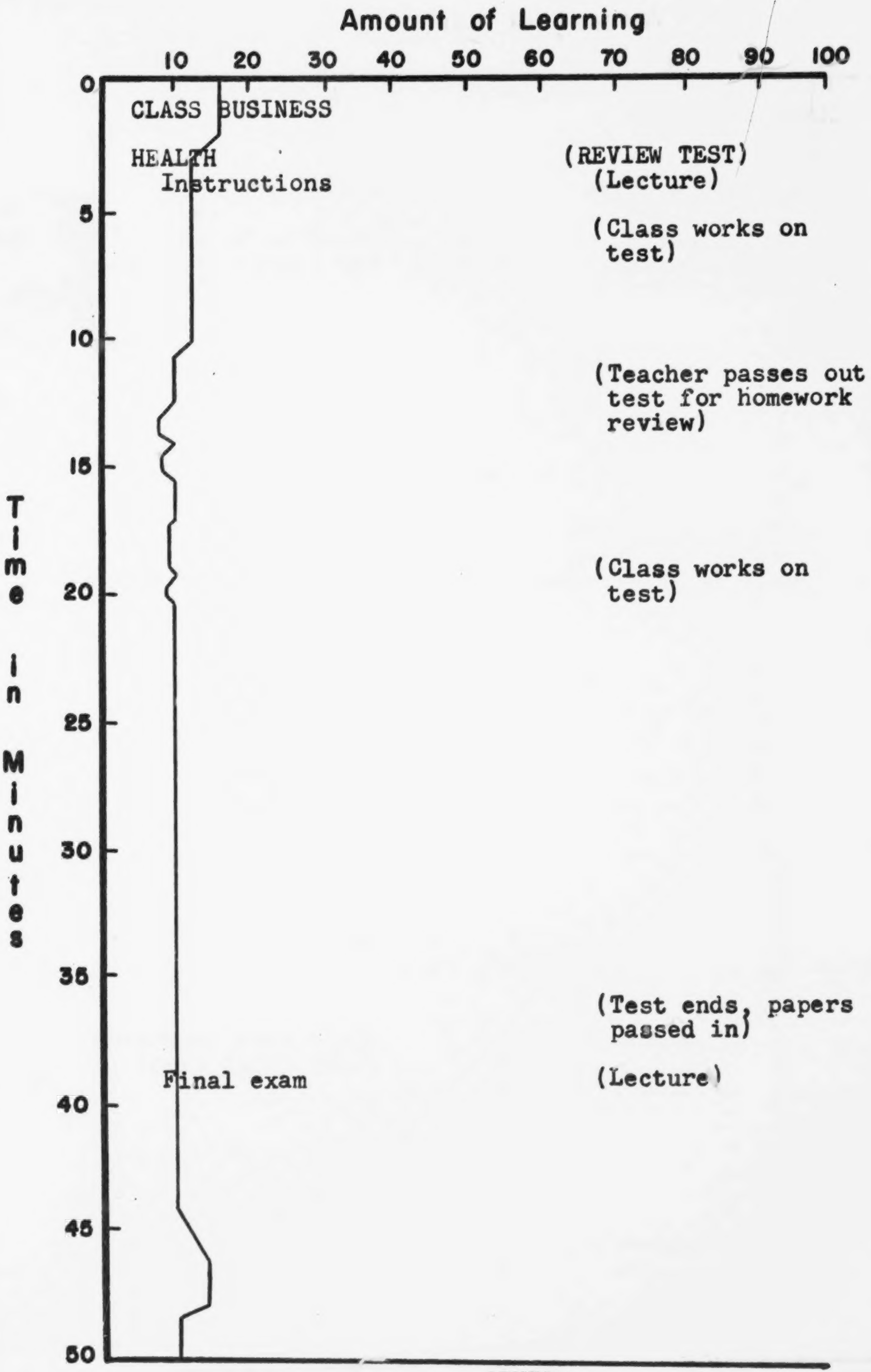




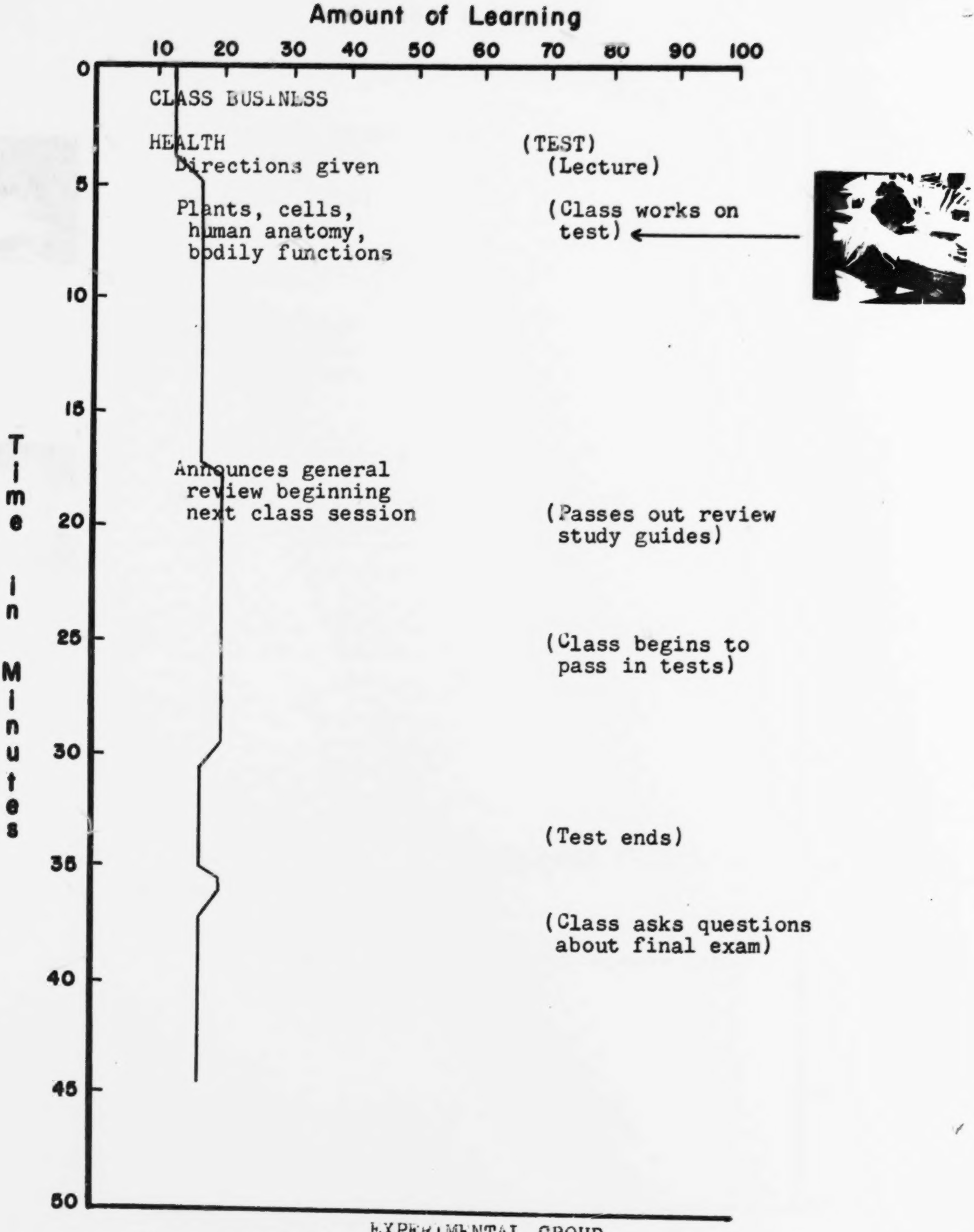


EXPERIMENTAL GROUP

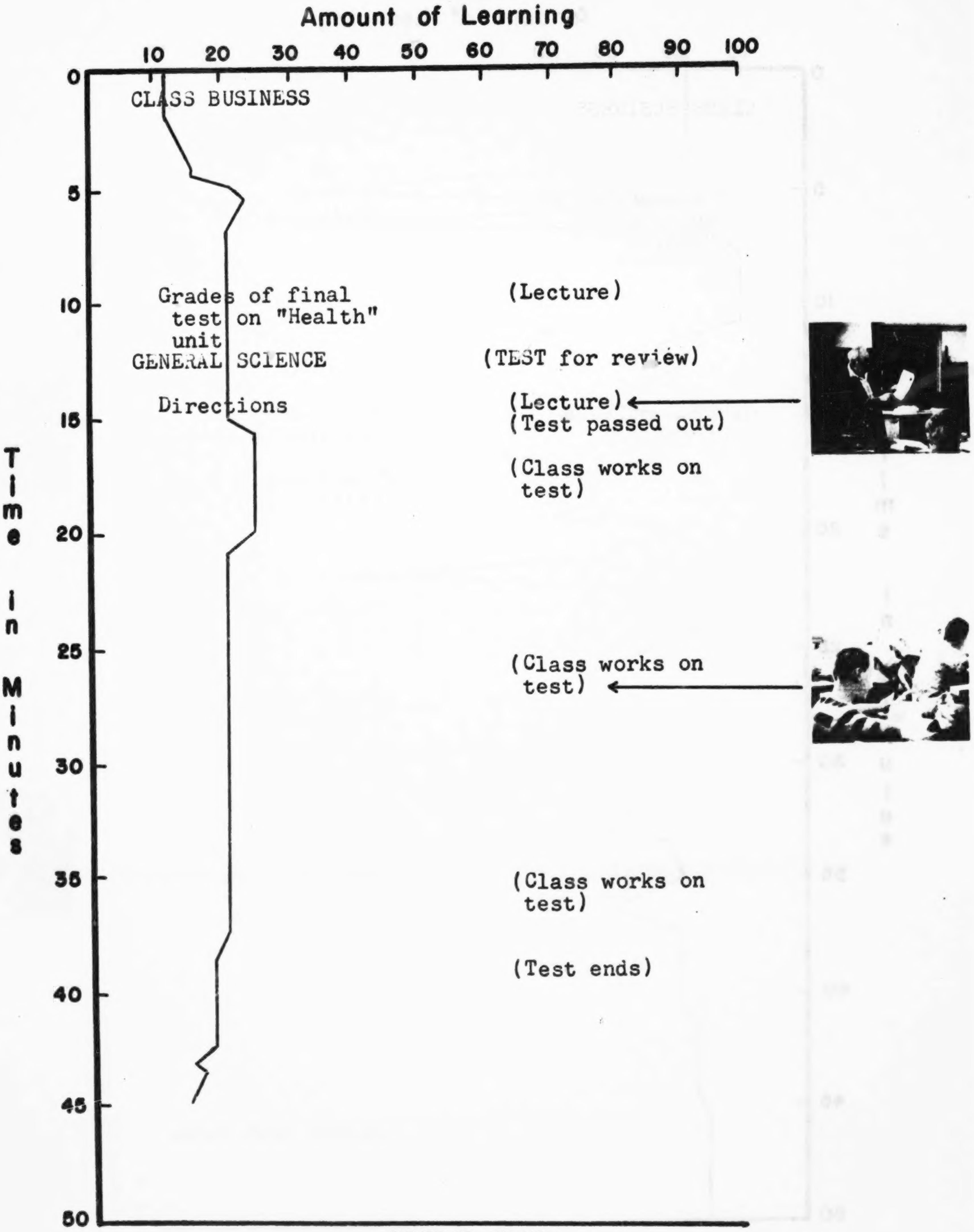
LEARNING PROFILE NUMBER 298



REVIEW
LEARNING PROFILE NUMBER 299

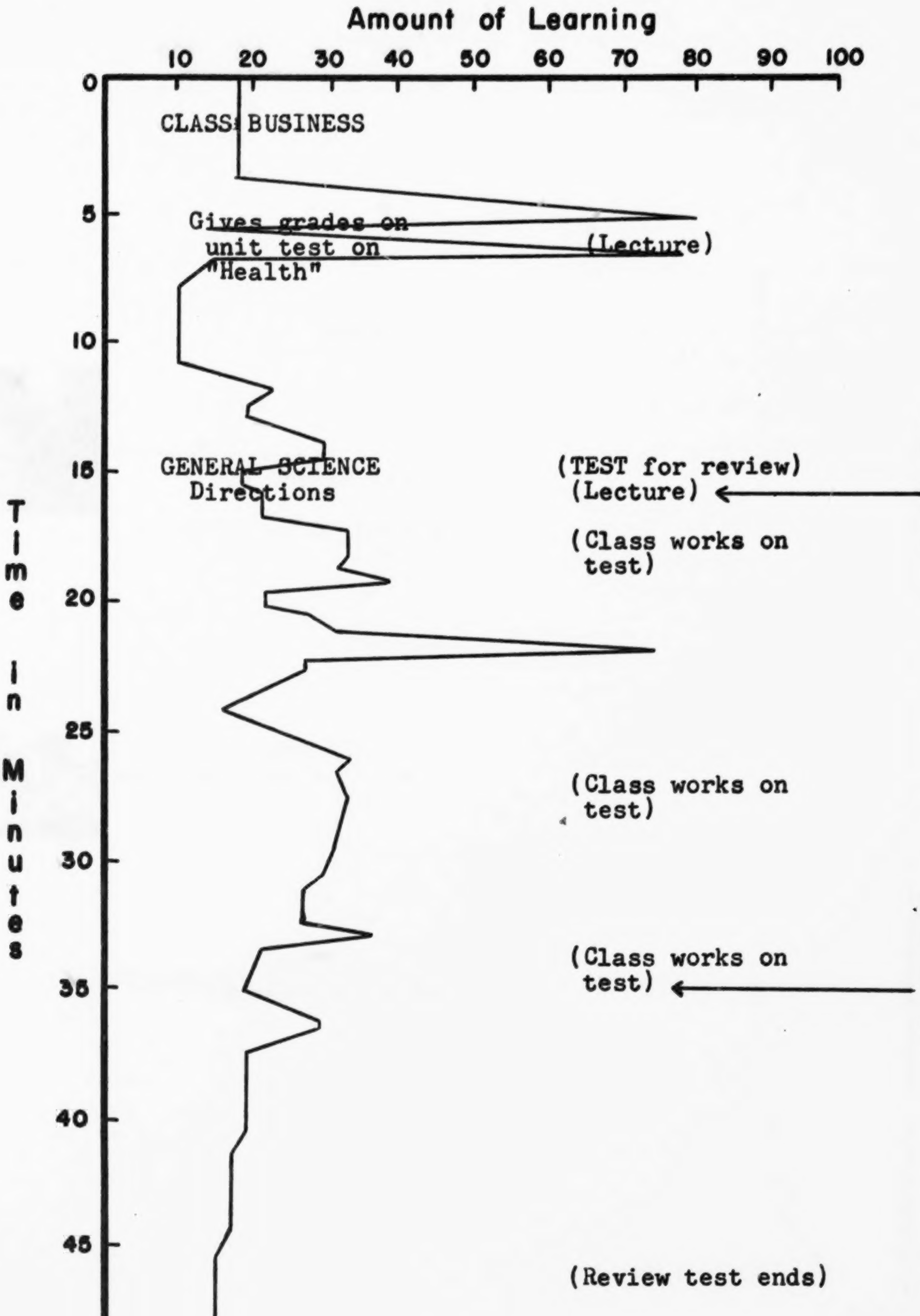


EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 300



CONTROL GROUP

LEARNING PROFILE NUMBER 301



EXPERIMENTAL GROUP
LEARNING PROFILE NUMBER 302

ANALYSIS OF LEARNING PROFILES 297 THROUGH 302

The use of a film* in the Control Group (C 297, 8-18) resulted in greater learning than in the Experimental Group (E 298, 27-42) with another film** on the same topic. Reasons for this may have been that the film in the Control Group was more closely related to the curriculum of this particular group, the quiz preceded the Experimental Group's film presentation, the latter film was longer, and the Experimental Group was more used to clear-cut, concise presentation such as found in a film.

Profiles 299 and 300 represent a test prepared by the teacher for both groups. In Profiles 301 and 302 another test*** was given to both groups for review. Apparently the Experimental Group learned more on some specific points as indicated by the high peaks; this may have been due to the fact that they had by the use of newer media gained a more adequate basis for comprehending the verbal abstractions as recorded in the test.

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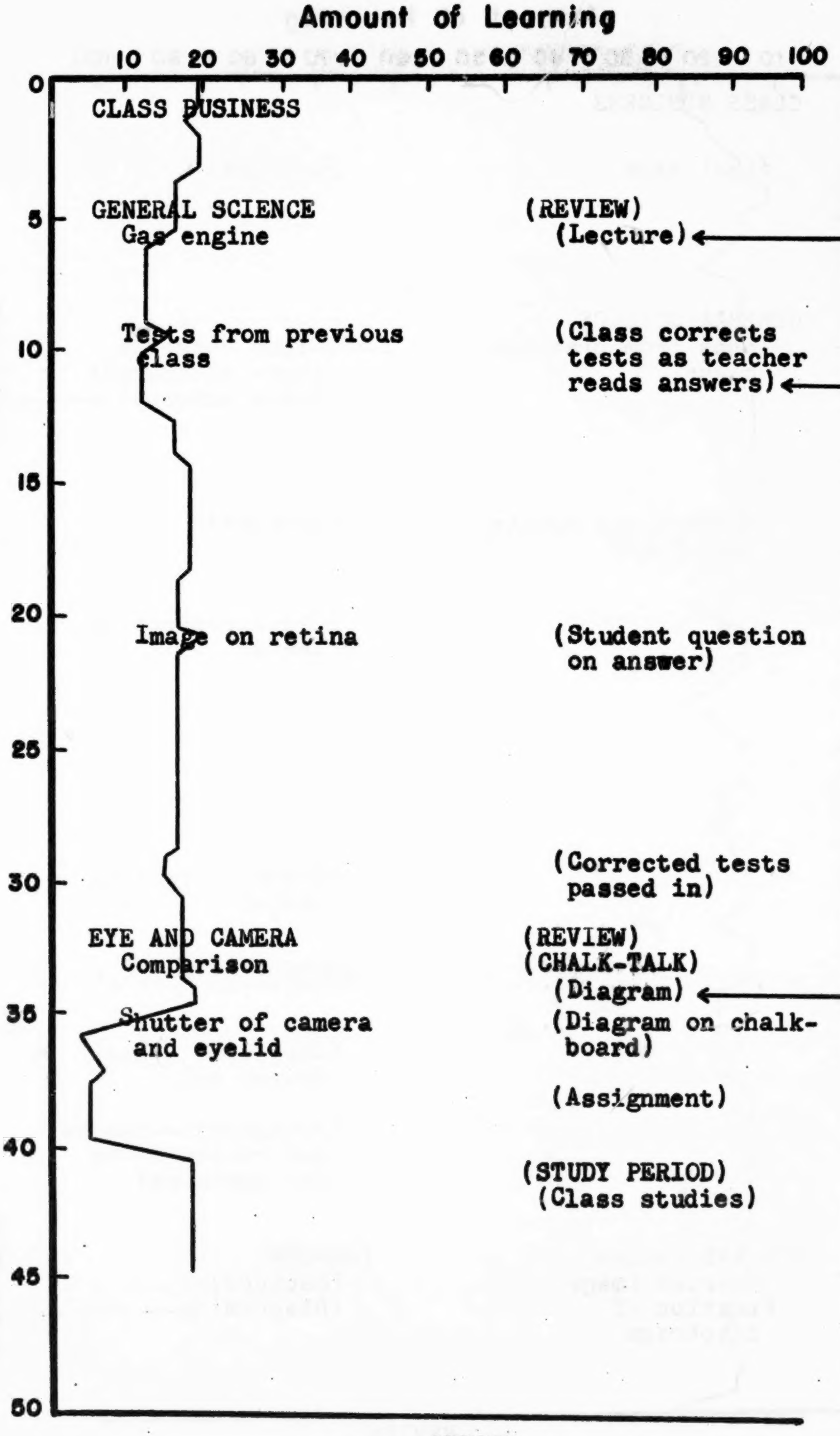
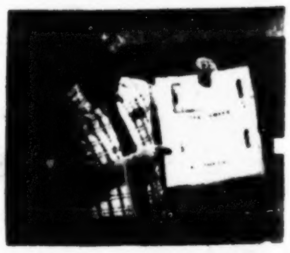
* "The Water Animals", ERPI Film Consultants Inc., 1931. Black and white, 6 minutes.

** "Microscopic Life:The World of the Invisible", Encyclopedia Britannica, 1958. Black and white, 14 minutes.

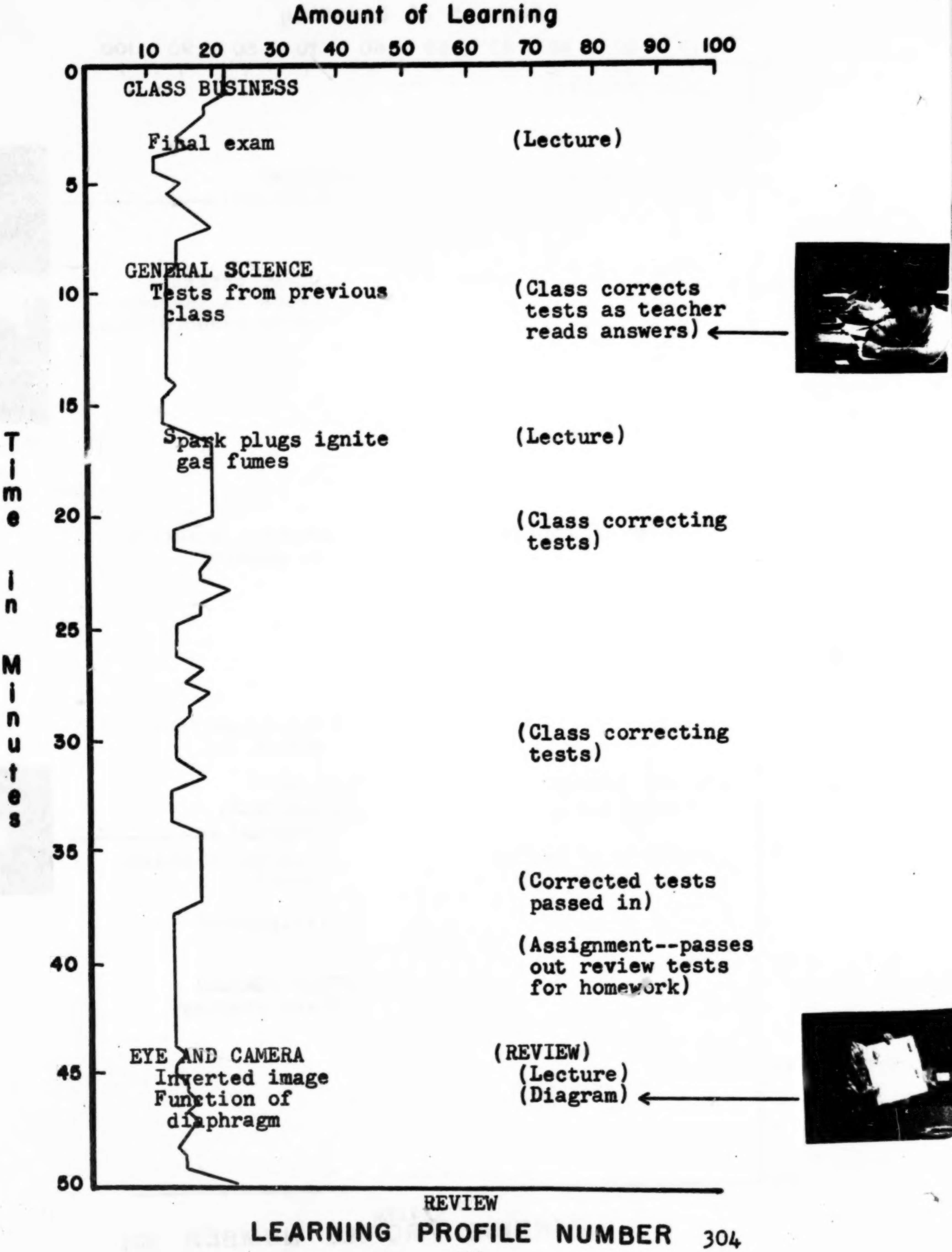
*** "General Science", Board of Education, Department of Science, Albany New York, 1961 (Part I, Final Examination, January).

** "Do All Shadows have Umbra and Penumbra?", Transparency X. F.; "Which Lens is Used?", X.D.; "Sharply Marked Shadows", X.G.; "Reflecting Surfaces", X.C.; "Parallel Circuits"; IX. MM, "Series Circuit", IX.LL, "Cells in Series", IX.JJ.; "Volt", IX.AA.; "Lead Storage Cell", IX.O.; "Electromagnet", IX. Q_1, Q_2, Q_3.; "Magnetic Field of Horseshoe Magnet", IX. R., Division of Educational Communications, New York State Education Department, 1960, 1961. 10" x 10" slides, 2 colors.





REVIEW
LEARNING PROFILE NUMBER 303



LEARNING PROFILE NUMBER 304

ANALYSIS OF LEARNING PROFILES 303 AND 304

Whereas learning dropped during a chalk-board presentation with diagraming, learning retained its level in the Experimental Group (E 304, 44-49) where a diagram of the same content from the text* was presented by opaque projection.

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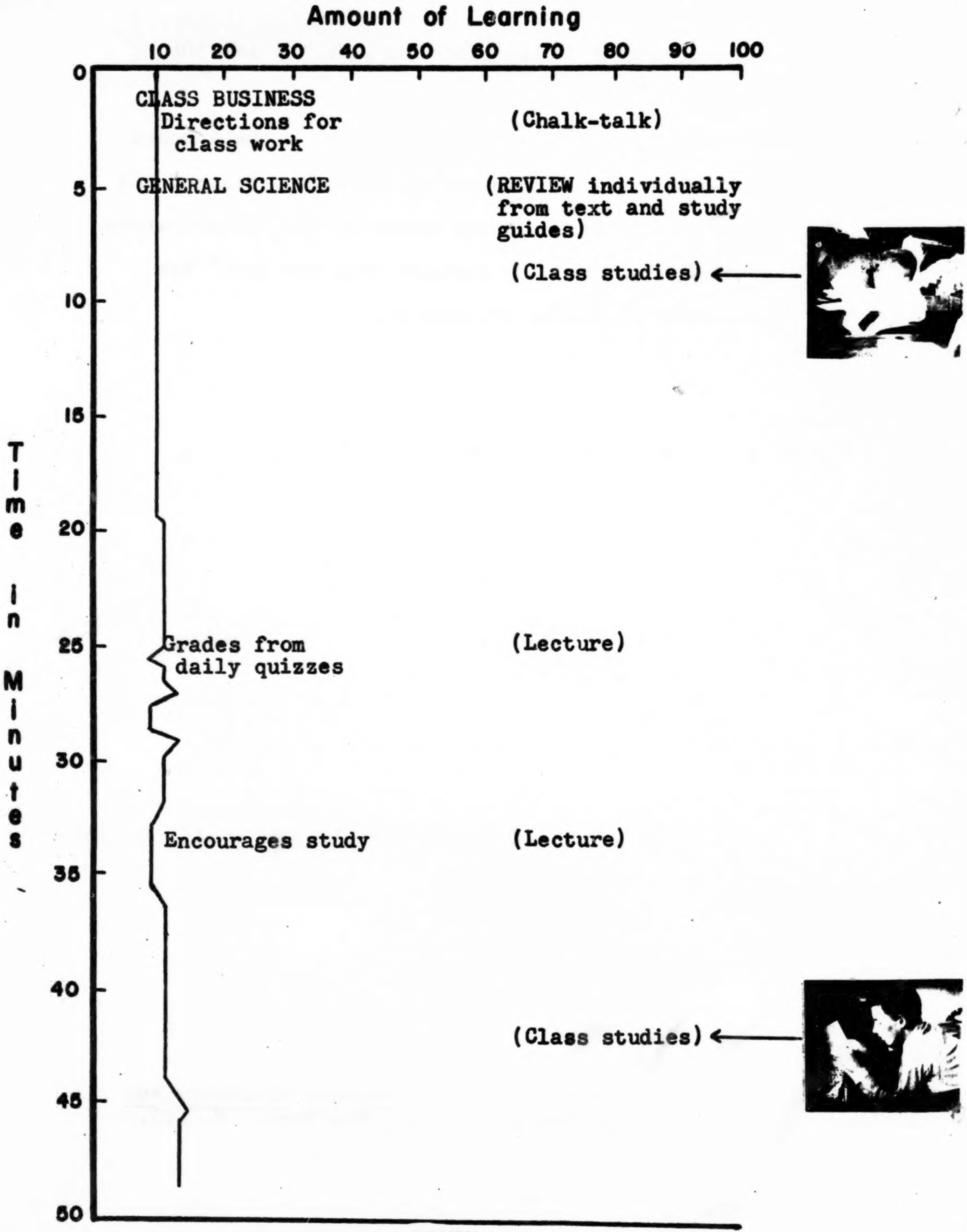
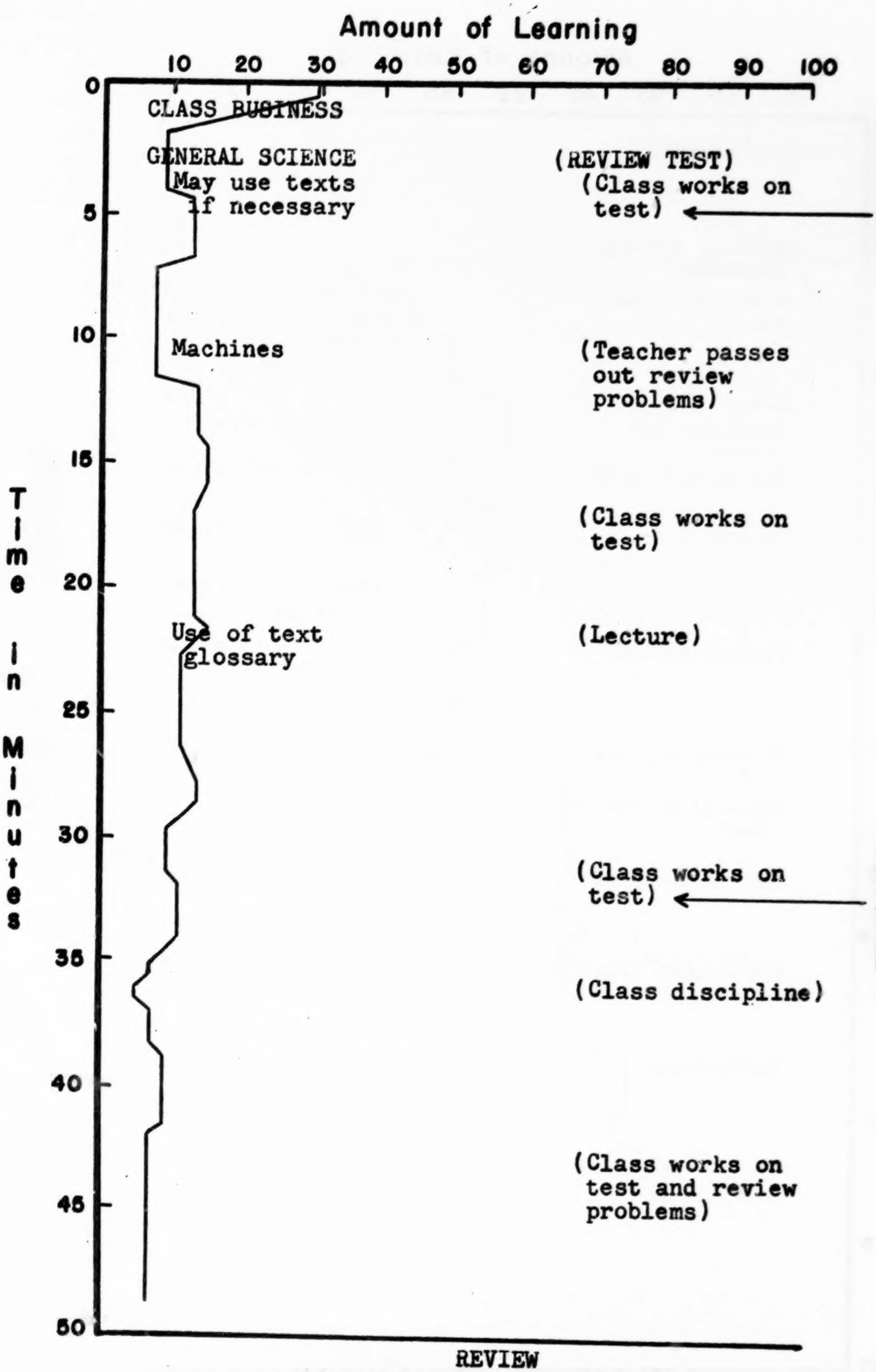
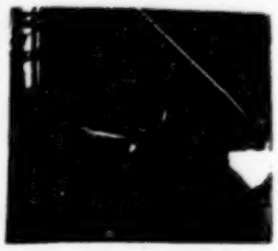
* John W. Davis and others, Science Discovery and Progress, Henry Holt Co., New York. P. 410.



REVIEW

LEARNING PROFILE NUMBER 305





REVIEW
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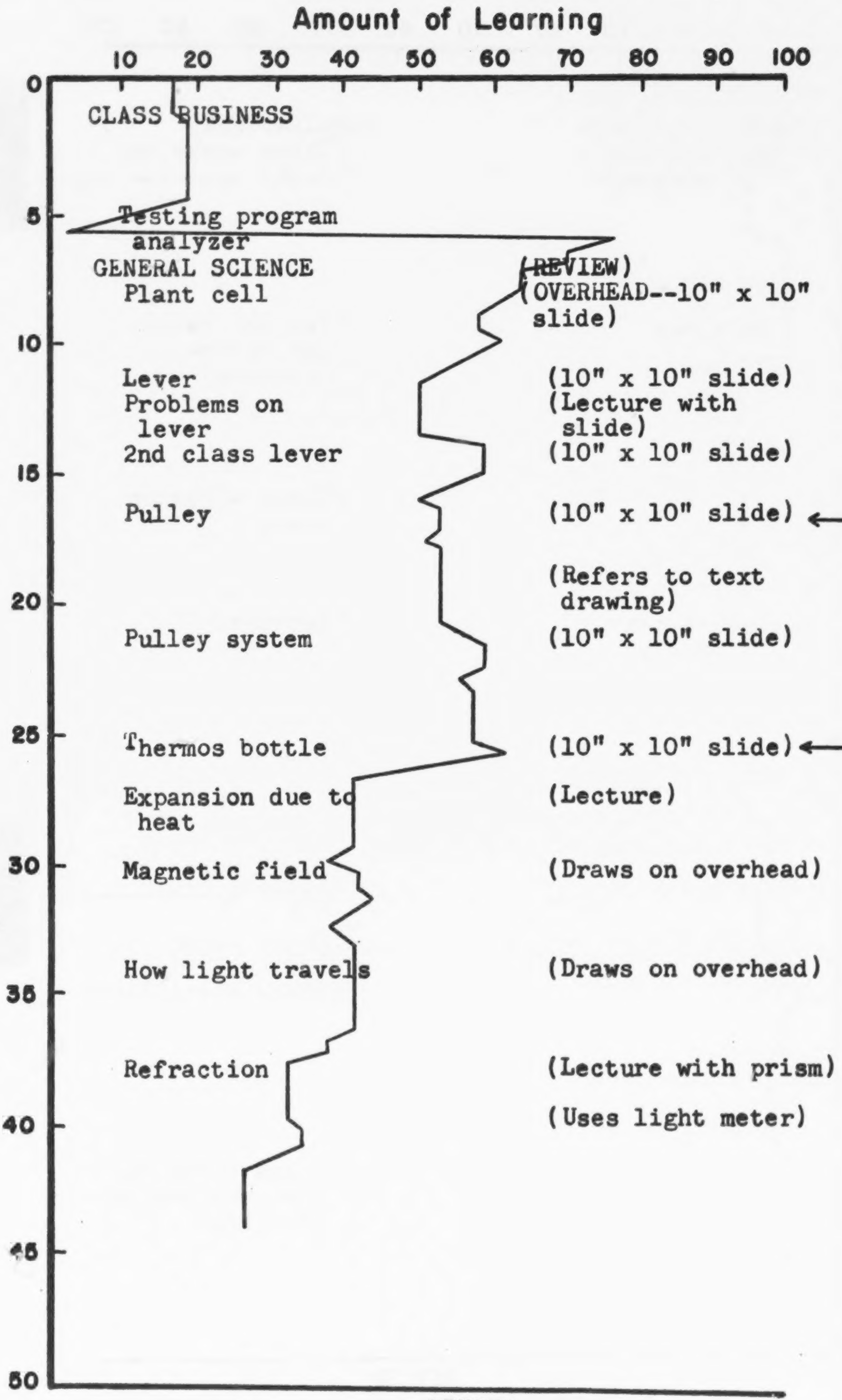
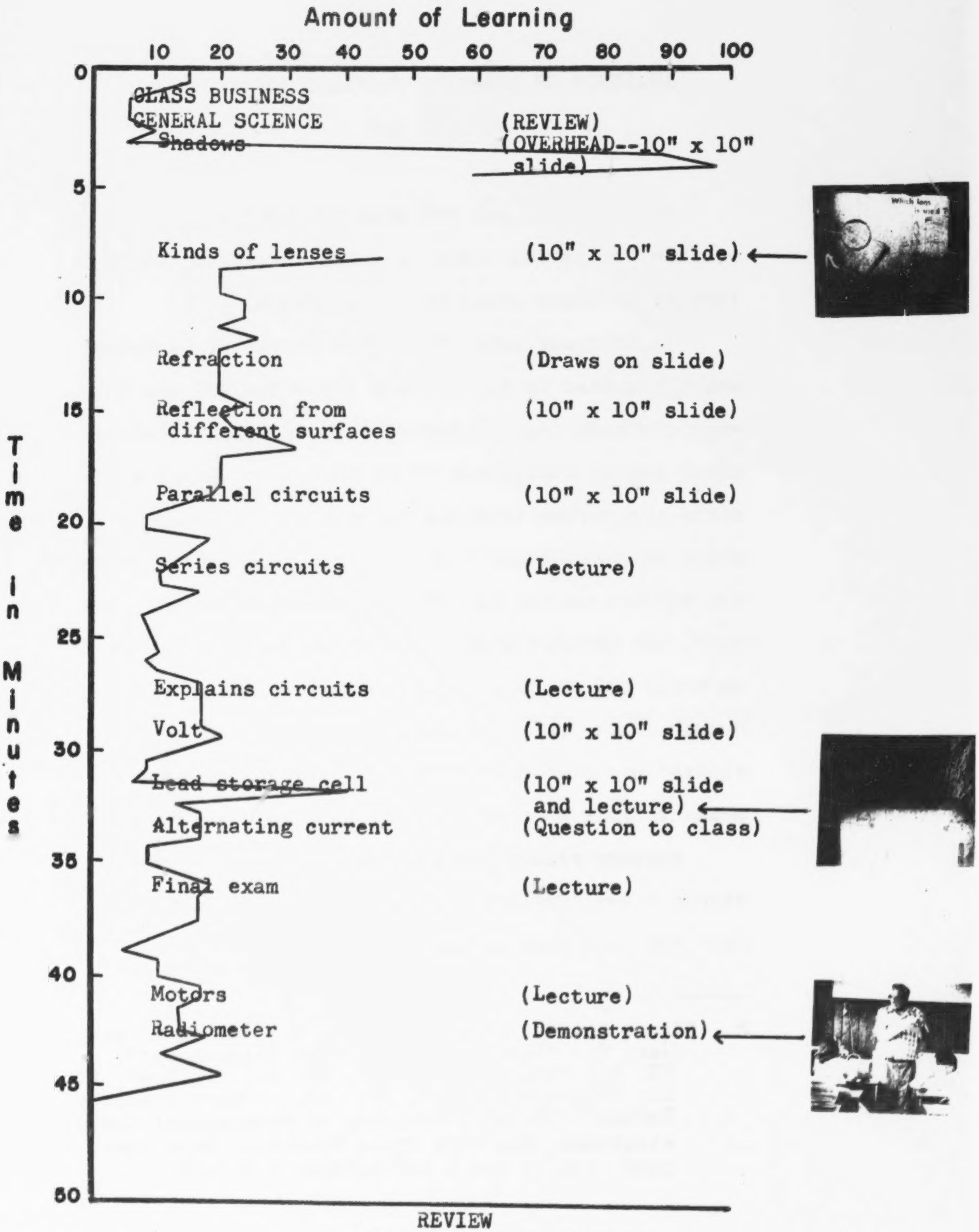


REVIEW

LEARNING PROFILE NUMBER 307



REVIEW

LEARNING PROFILE NUMBER 308

ANALYSIS OF LEARNING PROFILES 305 AND 306
and
307 AND 308

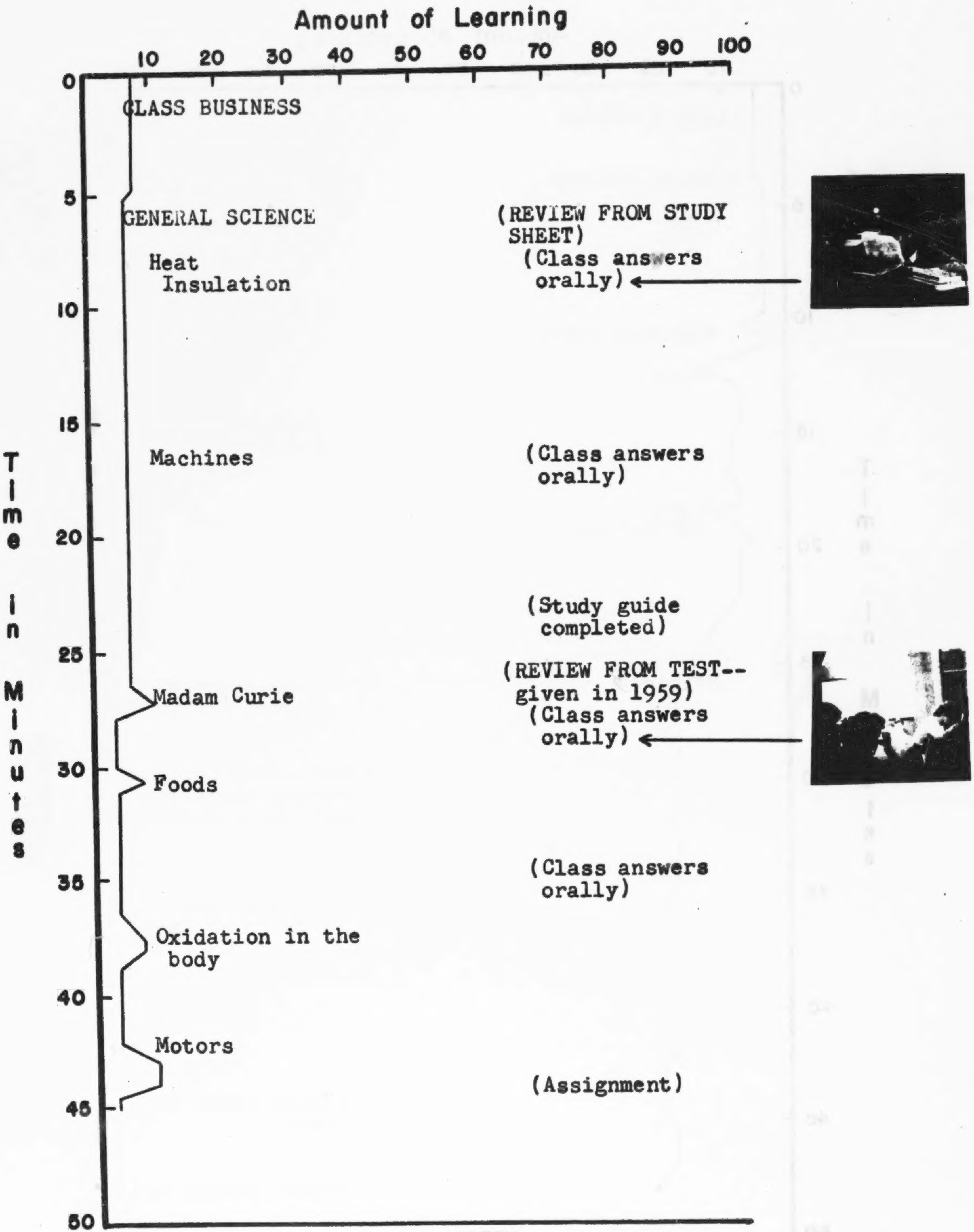
Profiles 305 and 306 show the typically low profile for review sessions which is typical whether lecture or class study is the approach.

In contrast note the higher levels of learning which resulted in both groups (Profiles 307 and 308) when overhead transparencies were utilized. Neither group can be considered to be Control or Experimental since the review involved subject matter areas in which each group had been an Experimental Group. Hence the subject matter is different for each group. However, the general high level of the class which was recently the Control Group (Profile 307) may be attributed to the fact that review by use of the overhead slides* was much more effective than by the other means of review which they had been experiencing.

Another reason for the lower profile in the second class (Profile 308) may have been due to the fact that too many slides** were used.

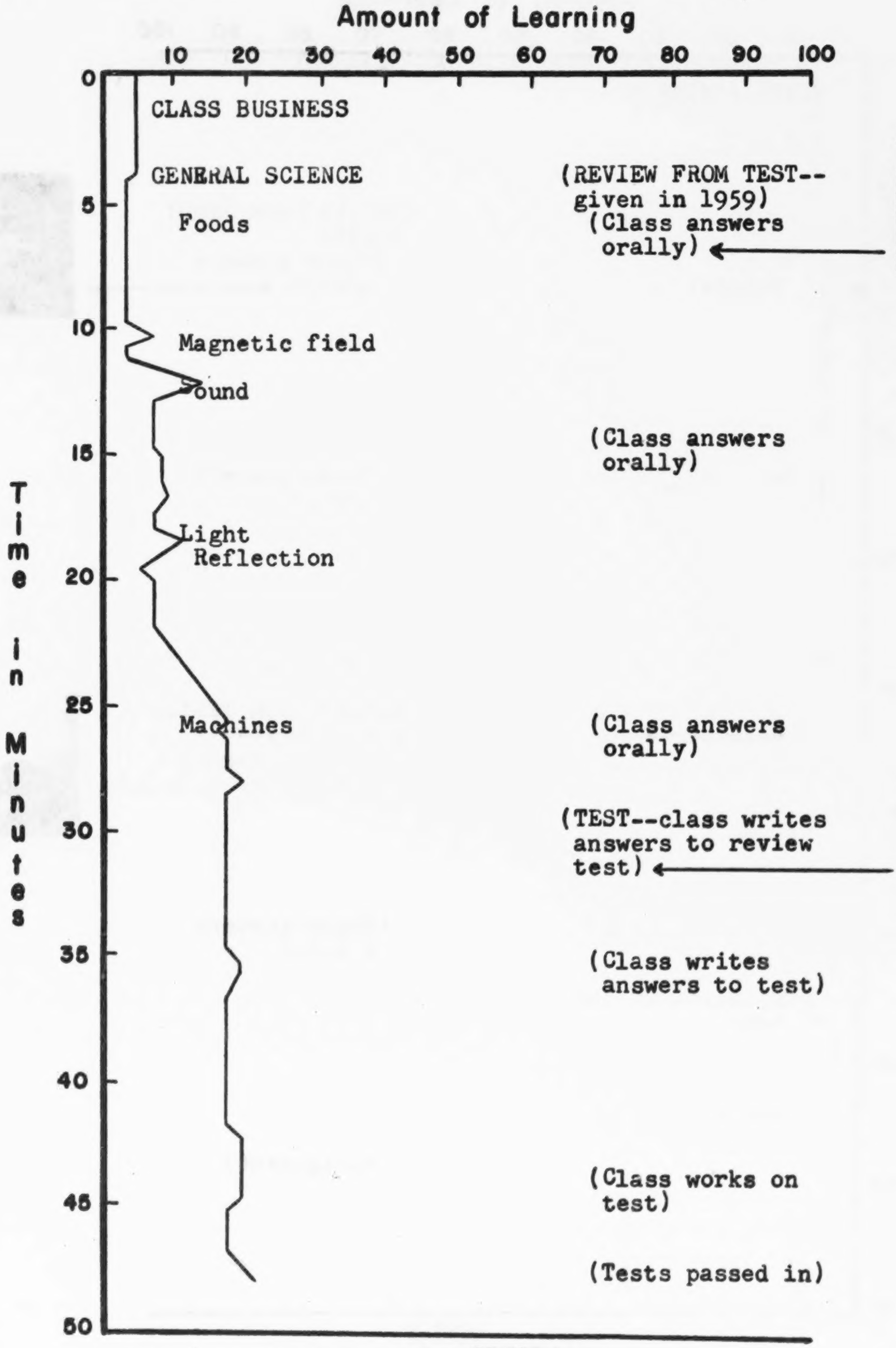
---

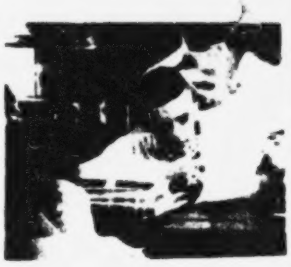
* "Plant Cell", Transparency XI. G.; "Clock in Bell Jar, V.; "Lever", VI. P.; "2nd Class Lever", VI. R.; "3rd Class Lever", VI. Q.; "Pulley", VI. i.; "Thermos Bottle", IV. AA.; "Thermos Bottle, Vacuum", IV. CC., Division of Educational Communications, New York State Education Department, 1960, 1961. 10" x 10" slides, 2 colors.



REVIEW

LEARNING PROFILE NUMBER 309





REVIEW
LEARNING PROFILE NUMBER 310

ANALYSIS OF LEARNING PROFILES 309 AND 310

The same test* presented for review purposes by the teacher in both groups resulted in low profiles, but again (as in Profile 302) the profile for the Experimental Group was higher indicating that possibly their greater background utilizing new media caused them to gain more learning during the study of the verbal symbols of the test.

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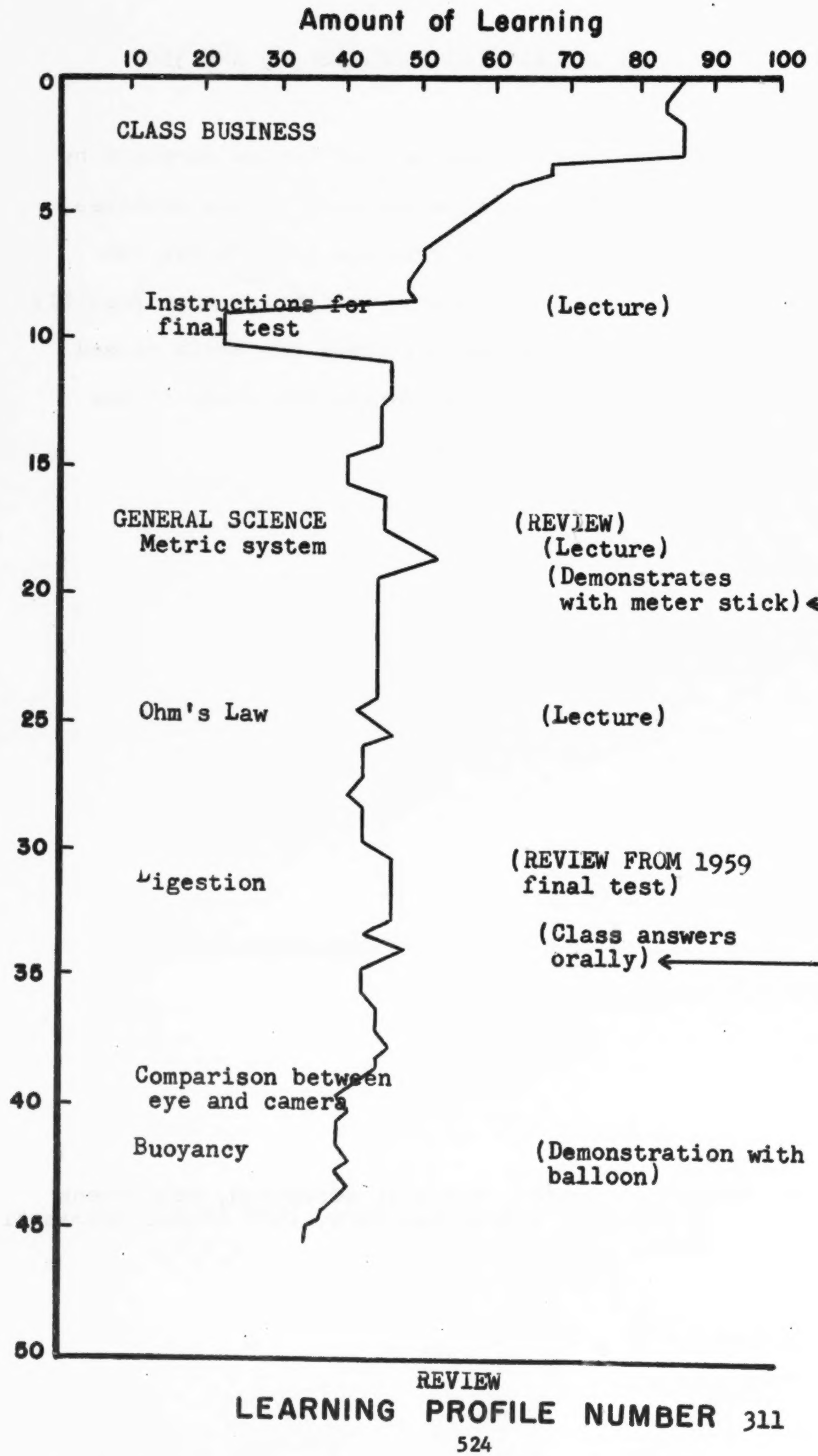
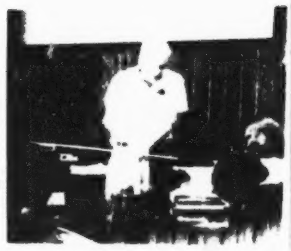
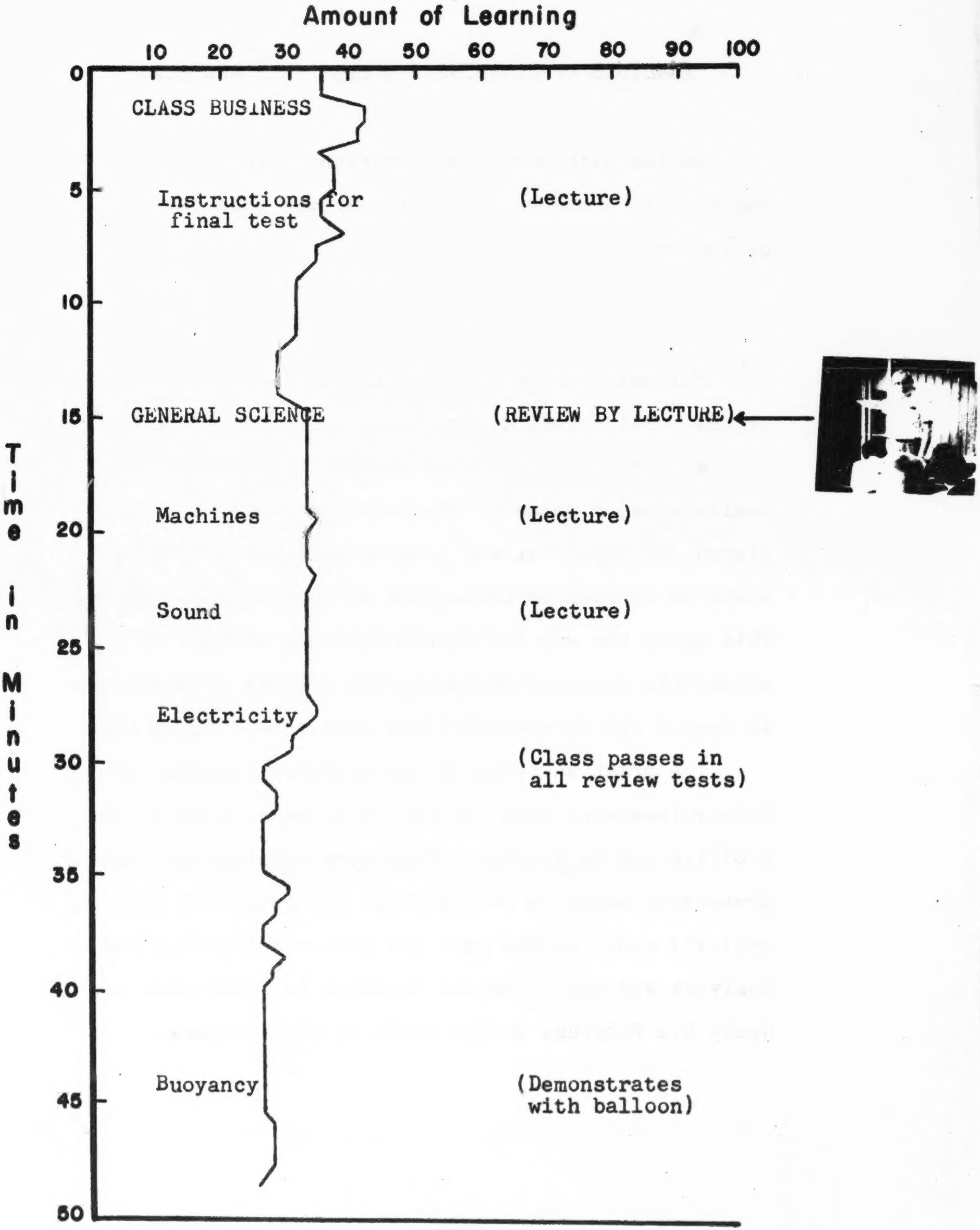
* "General Science", Board of Education, Department of Science, Albany,New York, 1959 (Final Examination, June).





REVIEW

LEARNING PROFILE NUMBER 311



REVIEW

LEARNING PROFILE NUMBER 312

ANALYSIS OF LEARNING PROFILES 311 AND 312

Review with some demonstrations (Profile 311) resulted in a higher level of learning than review by lecture.

*****

Following these profiles an examination prepared by the local school district was given to both groups.

With the completion of profile three-hundred and twelve a major phase of the research study was completed. We knew that the program analyzer technique could be carried on throughout an entire school year. This opens the way for future research studies by which this means of analyzing the process of learning in detail can be applied in various school situations.

The brief analyses of the profiles included in this volume were only indicative of ways by which the profiles may be studied. Much more detailed and comprehensive analysis is possible; the nature of such analysis would depend upon the person conducting the analysis and the situation in which he would plan to apply his findings on the basis of his analyses.